



US007901382B2

(12) **United States Patent**  
**Daily et al.**

(10) **Patent No.:** **US 7,901,382 B2**  
(45) **Date of Patent:** **Mar. 8, 2011**

- (54) **AUTOMATIC NEEDLE DEVICE**
- (75) Inventors: **David Daily**, Herzliya (IL); **Lior Raday**, D. N. Hof Ashkelon (IL)
- (73) Assignee: **Dali Medical Devices, Ltd.**, Rishon Le Zion (IL)
- (\*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 1135 days.

4,623,332 A	11/1986	Lindmayer et al.
4,902,279 A	2/1990	Schmidtz et al.
4,998,918 A	3/1991	Mimura et al.
5,092,842 A	3/1992	Bechtold et al.
5,137,516 A	8/1992	Rand et al.
5,215,536 A	6/1993	Lampropoulos et al.
5,267,963 A	12/1993	Bachynsky
5,295,965 A	3/1994	Wilmot
5,300,030 A	4/1994	Crossman et al.
5,320,609 A	6/1994	Haber et al.
5,478,316 A	12/1995	Bitdinger et al.
5,527,287 A	6/1996	Miskinyar

(Continued)

(21) Appl. No.: **10/572,215**

**FOREIGN PATENT DOCUMENTS**

(22) PCT Filed: **Sep. 15, 2004**

CA 2356614 A1 4/2000

(86) PCT No.: **PCT/IL2004/000852**

(Continued)

§ 371 (c)(1),  
(2), (4) Date: **Sep. 8, 2006**

**OTHER PUBLICATIONS**

(87) PCT Pub. No.: **WO2005/025637**

US 5,954,699, 09/1999, Jost et al. (withdrawn)

PCT Pub. Date: **Mar. 24, 2005**

*Primary Examiner* — Kevin C Sirmons

(65) **Prior Publication Data**

*Assistant Examiner* — Deanna K Hall

US 2007/0118081 A1 May 24, 2007

(74) *Attorney, Agent, or Firm* — Fish & Richardson P.C.

(30) **Foreign Application Priority Data**

(57) **ABSTRACT**

Sep. 17, 2003 (IL) ..... 157984

(51) **Int. Cl.**  
**A61M 5/00** (2006.01)

(52) **U.S. Cl.** ..... **604/187; 604/137**

(58) **Field of Classification Search** ..... 604/187,  
604/137, 131, 156

See application file for complete search history.

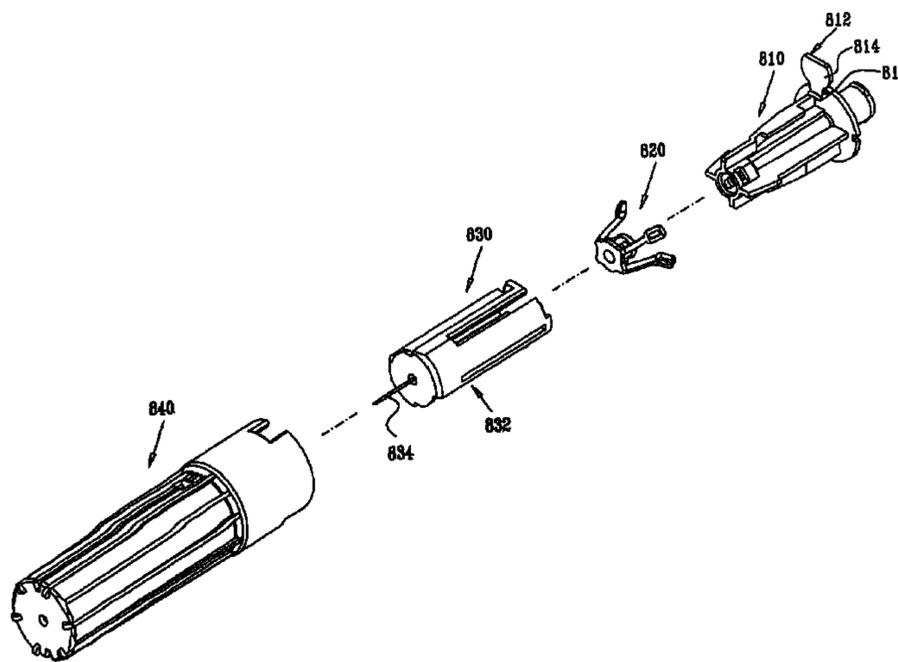
An automatic needle device including a housing element, at least one resilient element arranged to be located within the housing element, at least one needle bearing element adapted, when actuated, to be displaced by the at least one resilient element with respect to the housing element from a non-penetration position to a penetration position and a needle guard adapted for positioning with respect to the housing element and wherein displacement of the needle guard is operative to actuate displacement of the at least one needle bearing element from the non-penetration position to the penetration position.

(56) **References Cited**

**U.S. PATENT DOCUMENTS**

4,333,457 A 6/1982 Margulies  
4,592,742 A 6/1986 Landau et al.

**40 Claims, 82 Drawing Sheets**



# US 7,901,382 B2

Page 2

## U.S. PATENT DOCUMENTS

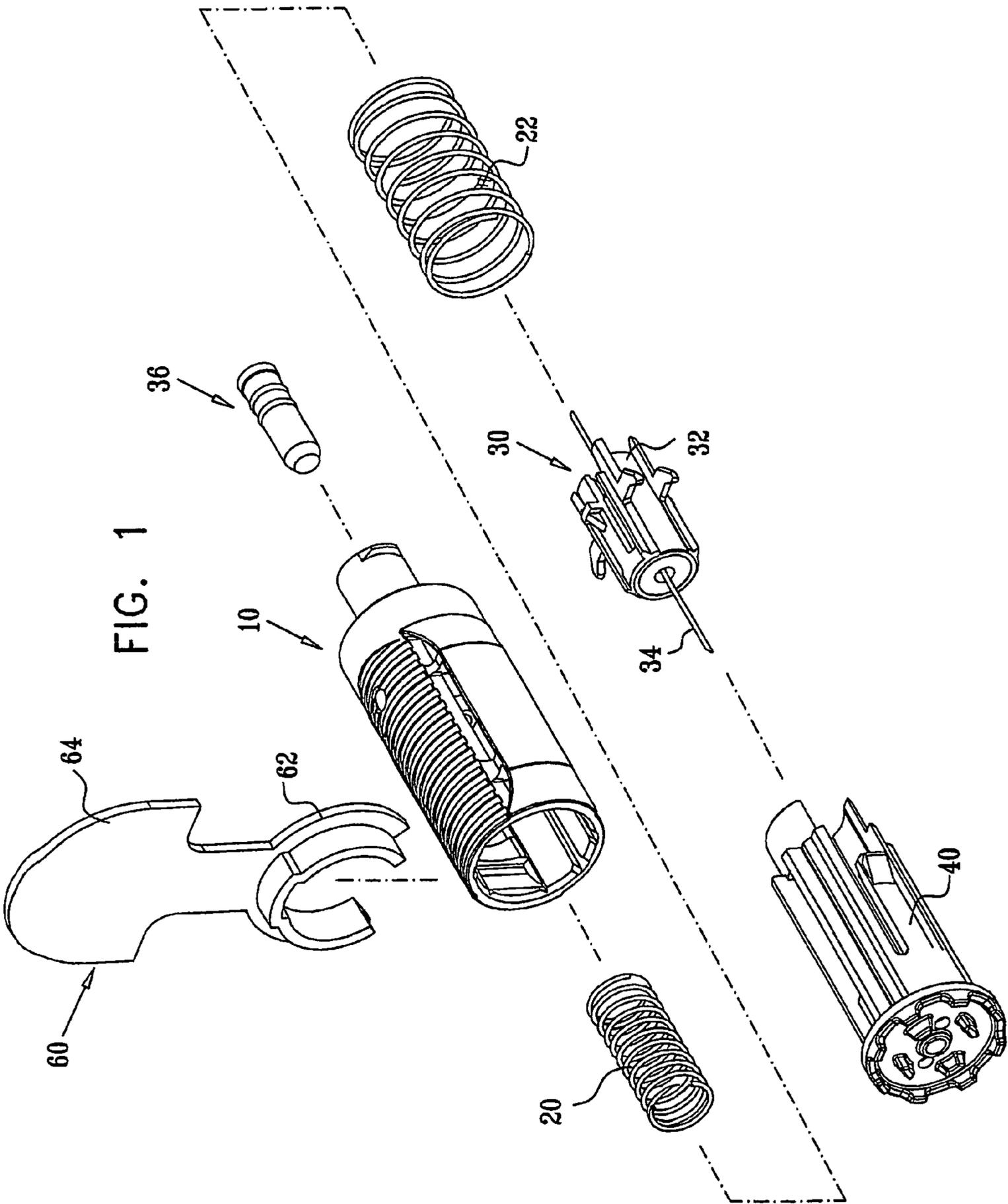
5,584,815 A 12/1996 Pawelka et al.  
5,599,309 A 2/1997 Marshall et al.  
5,616,128 A 4/1997 Meyer  
5,665,071 A 9/1997 Wyrick  
5,681,291 A 10/1997 Galli  
5,695,472 A 12/1997 Wyrick  
5,779,677 A 7/1998 Frezza  
5,823,998 A 10/1998 Yamagata  
5,957,897 A 9/1999 Jeffrey  
6,015,396 A 1/2000 Buttgen et al.  
6,070,623 A 6/2000 Aneas  
6,099,503 A 8/2000 Stradella  
6,099,504 A 8/2000 Gross et al.  
6,149,626 A 11/2000 Bachynsky et al.  
6,159,181 A 12/2000 Crossman et al.  
6,241,708 B1 6/2001 Reilly et al.  
6,280,421 B1 8/2001 Kirchhofer et al.  
6,319,233 B1 11/2001 Jansen et al.  
6,387,078 B1 5/2002 Gillespie  
6,530,903 B2 3/2003 Wang et al.  
6,544,234 B1 4/2003 Gabriel  
6,565,553 B2 5/2003 Sadowski et al.  
6,572,590 B1 6/2003 Stevens et al.  
6,585,690 B1 7/2003 Hoeck et al.  
6,592,555 B1 7/2003 Wen et al.  
6,595,962 B1 7/2003 Perthu

6,605,058 B1 8/2003 Wich  
6,605,067 B1 8/2003 Larsen  
6,607,508 B2 8/2003 Knauer  
6,613,019 B2 9/2003 Munk  
6,620,137 B2 9/2003 Kirchhofer et al.  
6,638,255 B1 10/2003 Weber  
6,673,049 B2 1/2004 Hommann et al.  
6,685,676 B2 2/2004 Jansen et al.  
6,971,999 B2 12/2005 Py et al.  
2001/0037087 A1 11/2001 Knauer  
2002/0133122 A1\* 9/2002 Giambattista et al. .... 604/198  
2003/0093036 A1 5/2003 Crossman et al.  
2003/0105430 A1 6/2003 Lavi et al.

## FOREIGN PATENT DOCUMENTS

EP 1034809 A1 9/2000  
FR 2770404 7/1999  
WO 9903529 1/1999  
WO WO0224259 A3 6/2002  
WO 03/047663 6/2003  
WO 2004060445 7/2004  
WO WO2005025636 A2 3/2005  
WO WO2005025637 A2 3/2005  
WO WO2005086587 A2 9/2005  
WO WO2008047372 A2 4/2008

\* cited by examiner



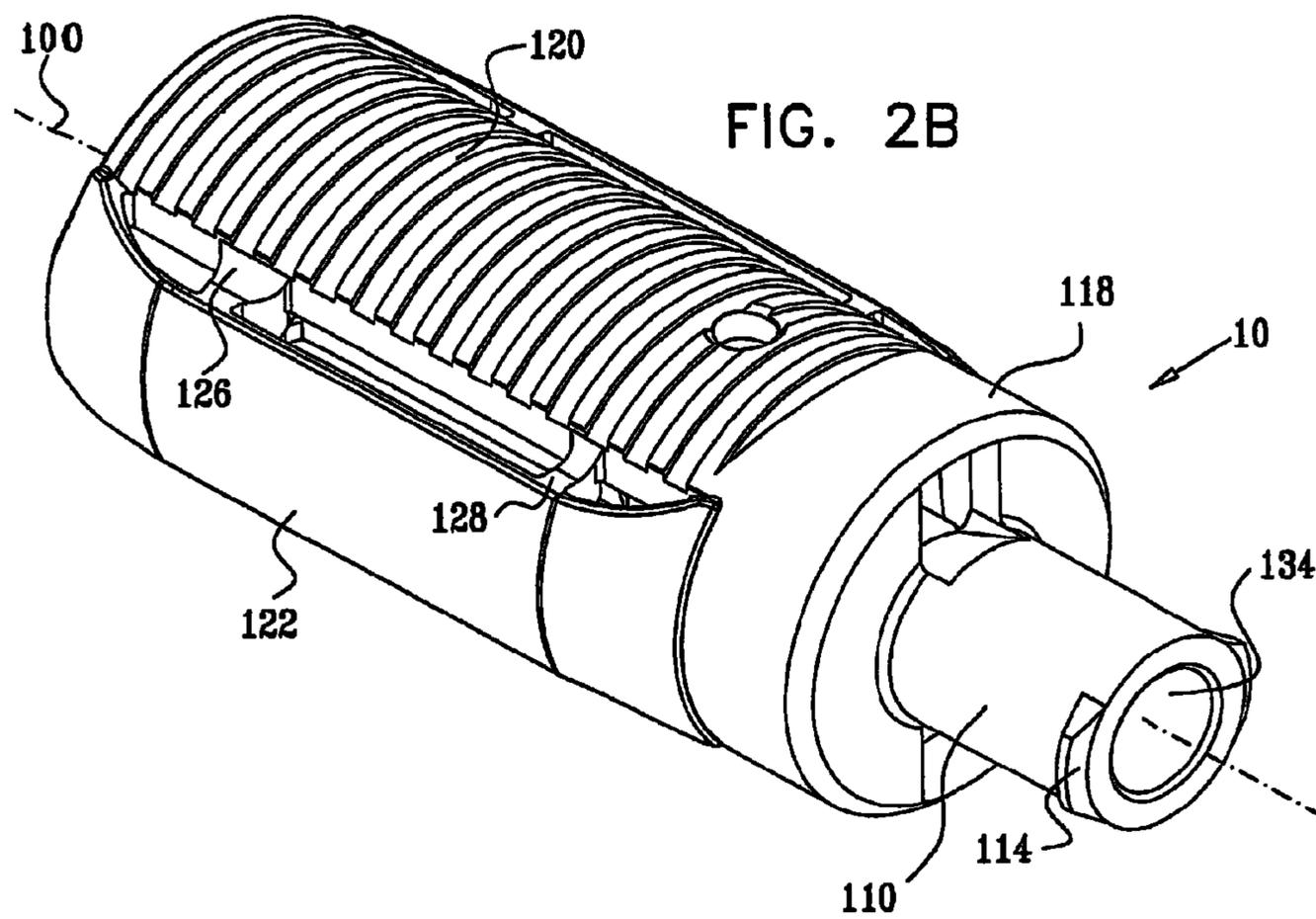
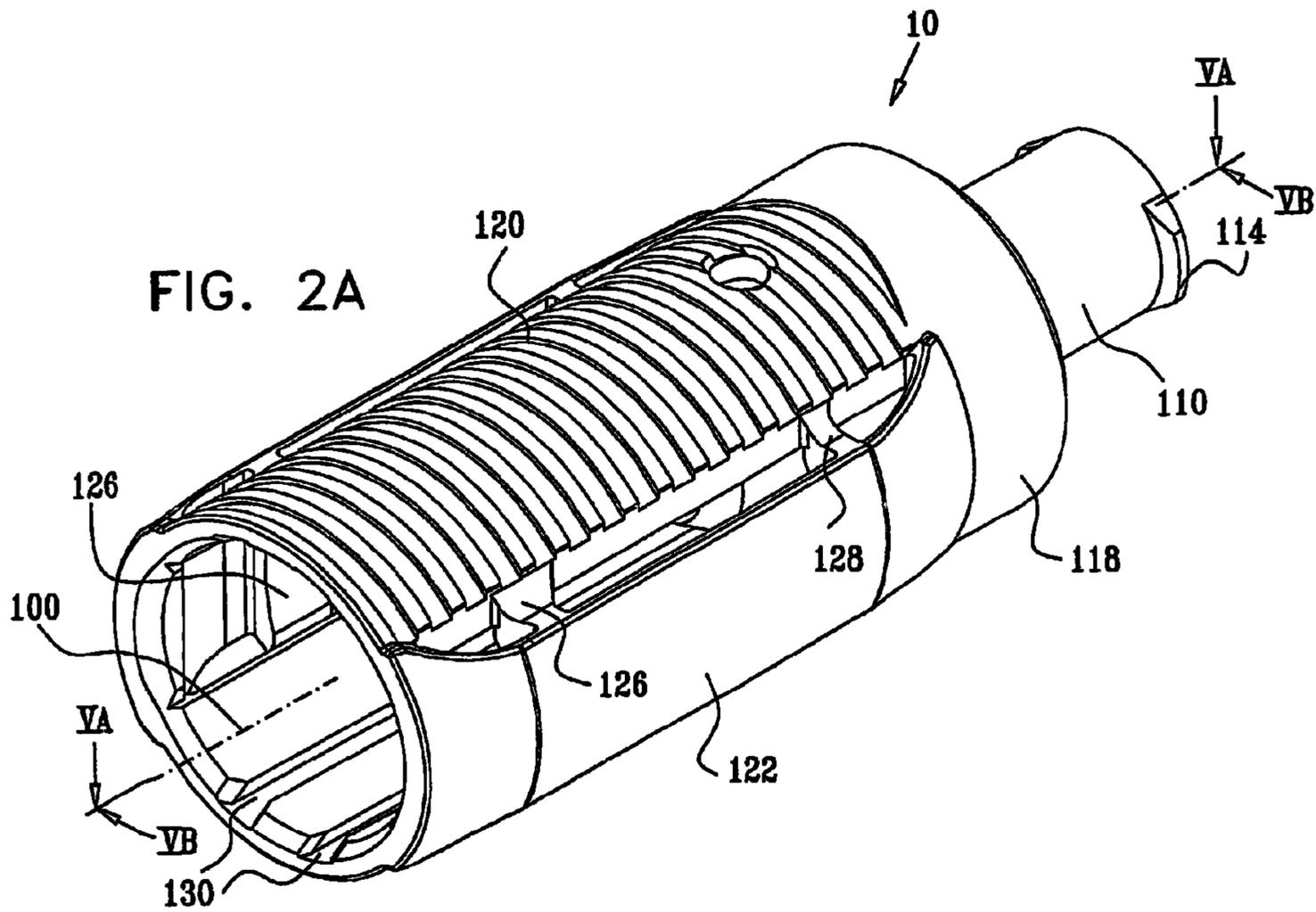


FIG. 3A

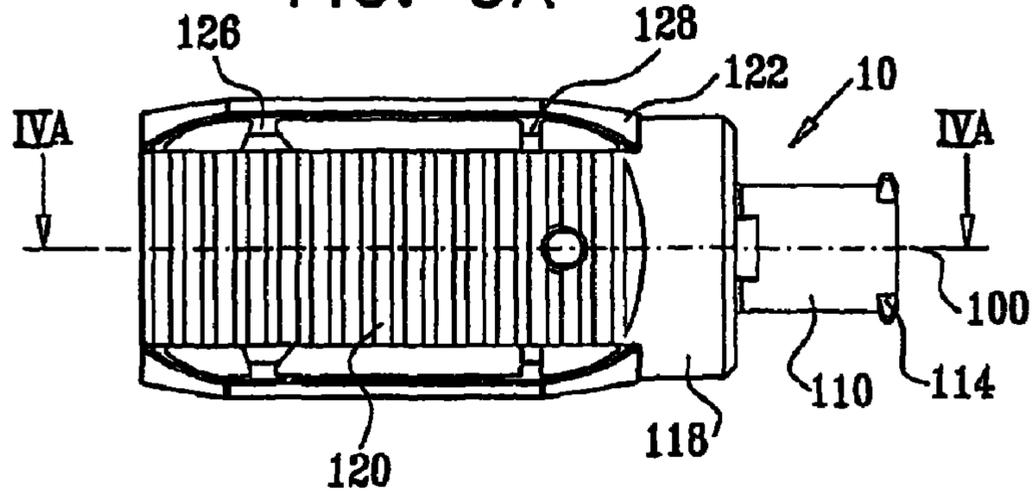


FIG. 3B

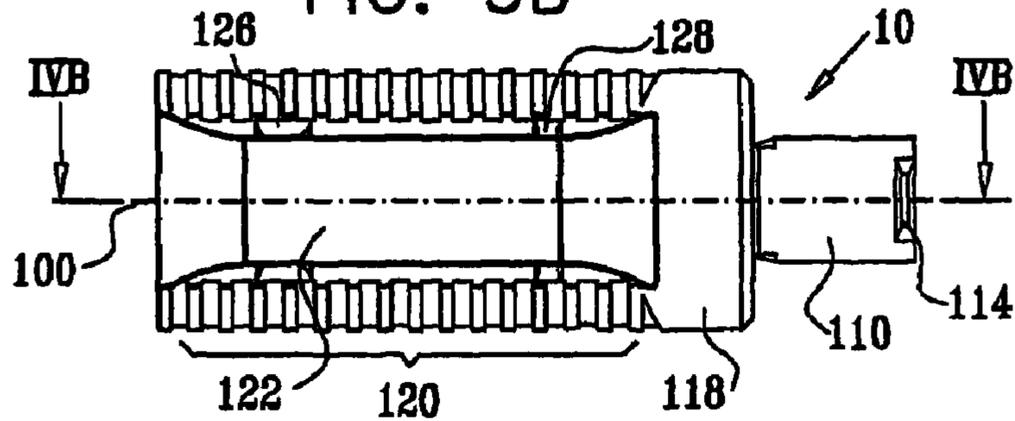


FIG. 4A

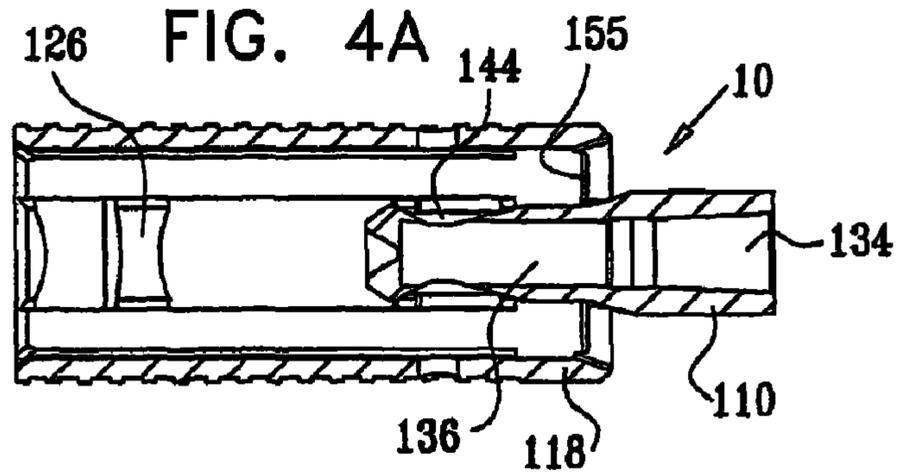
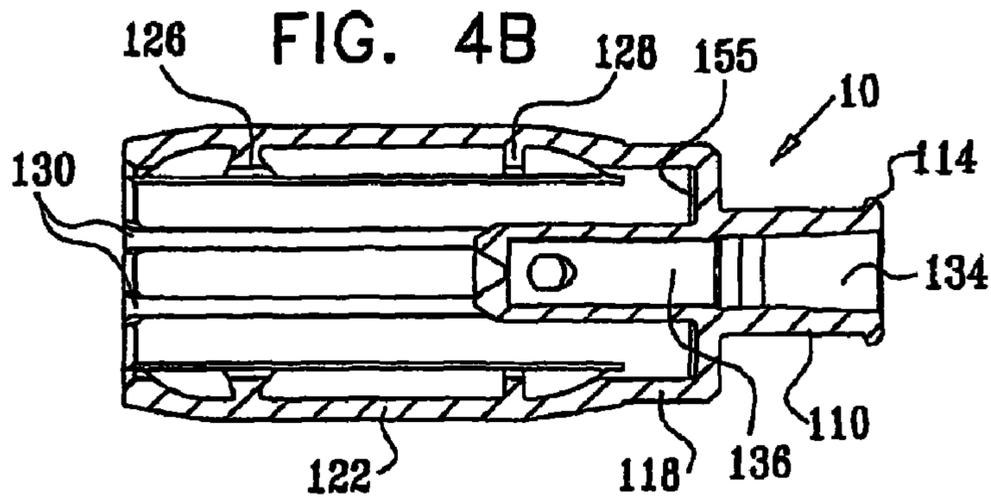
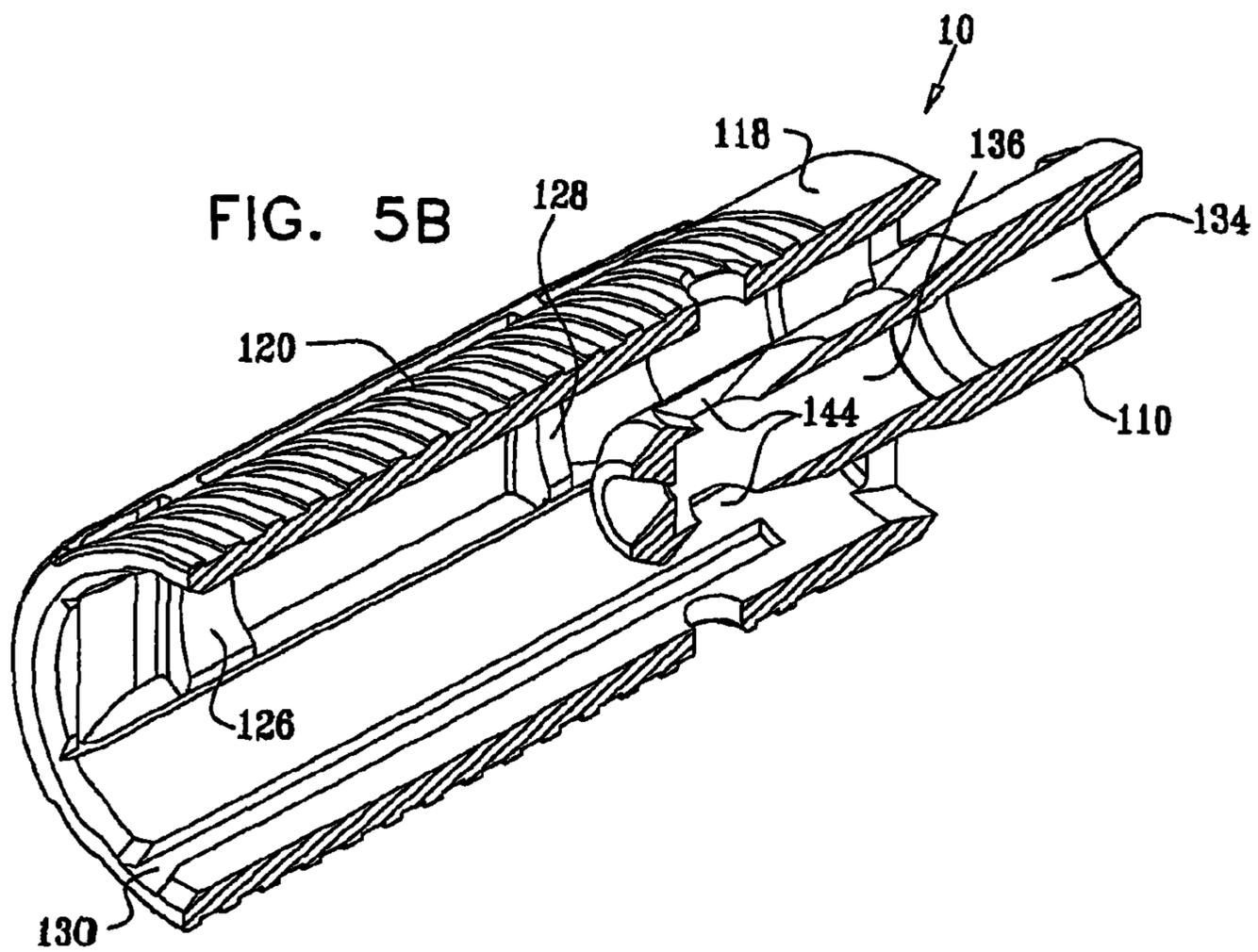
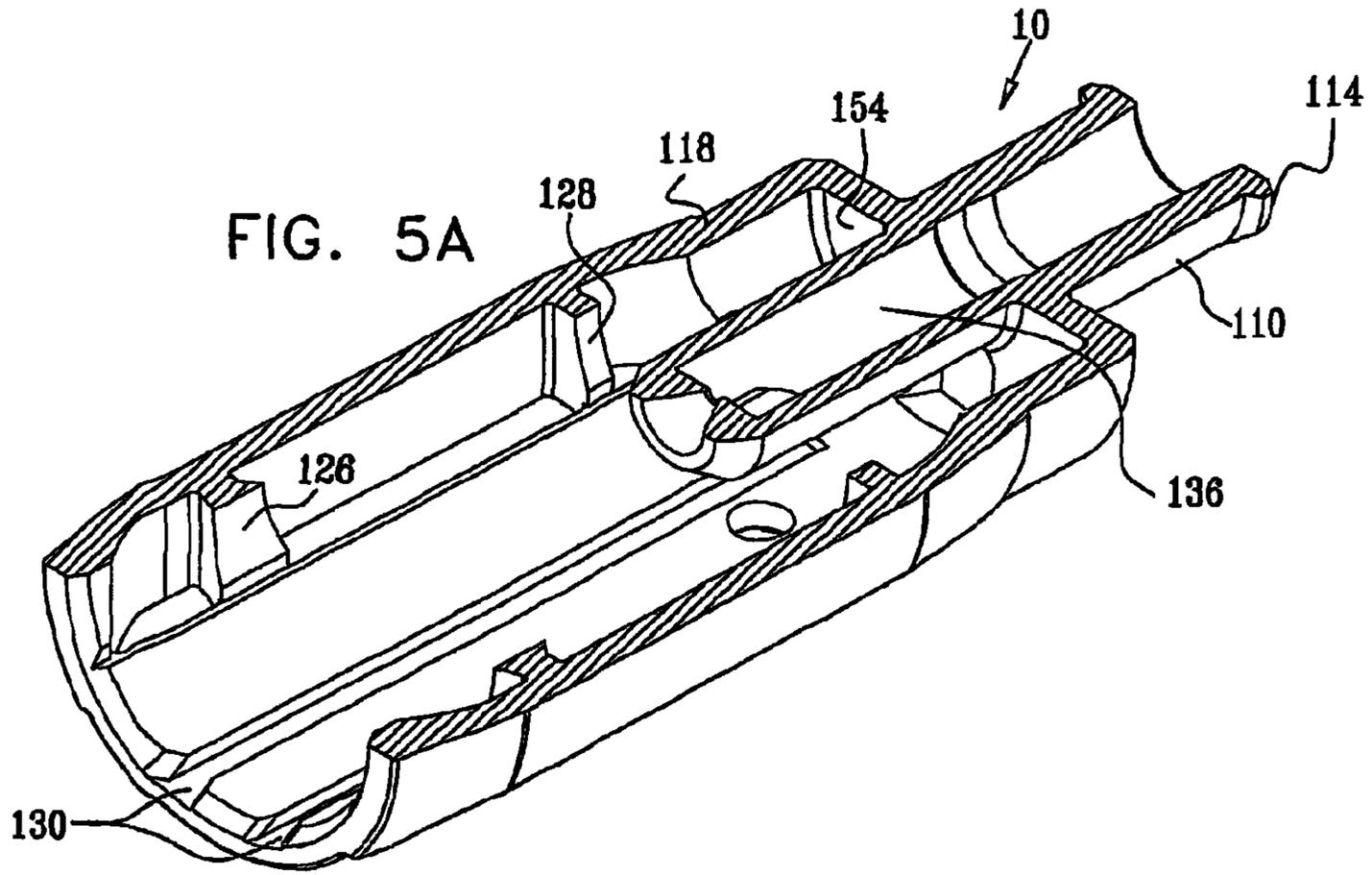
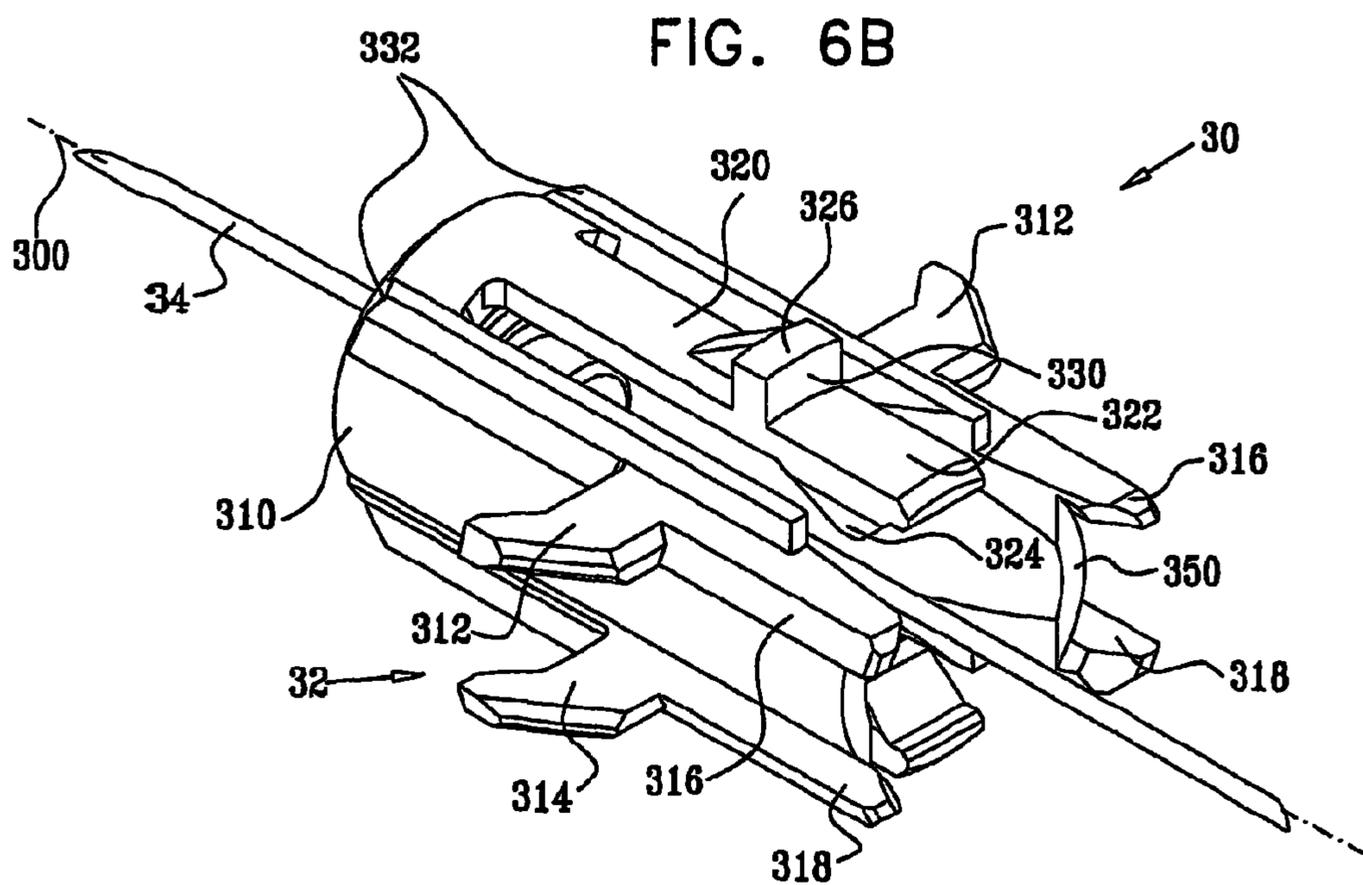
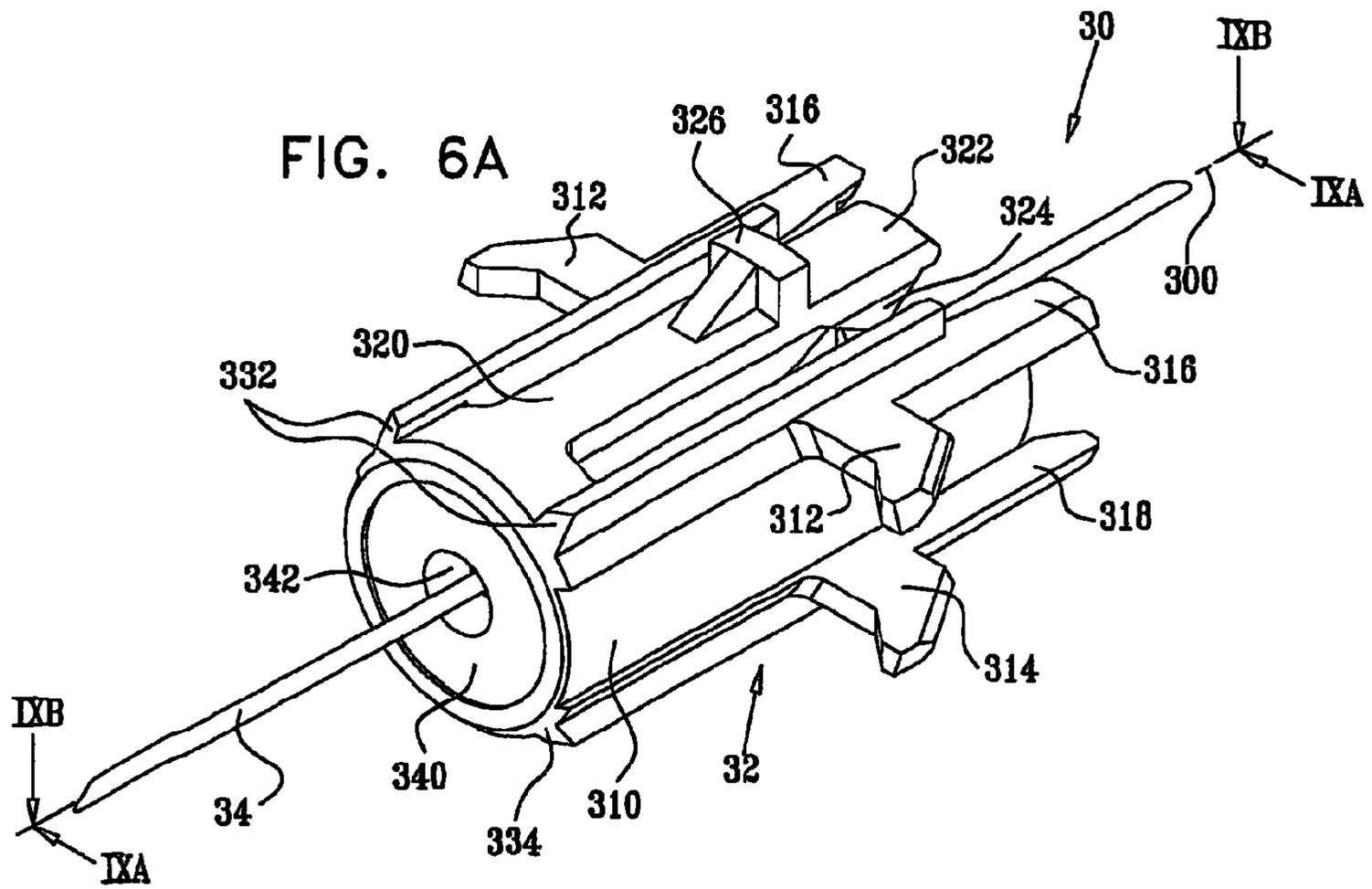


FIG. 4B







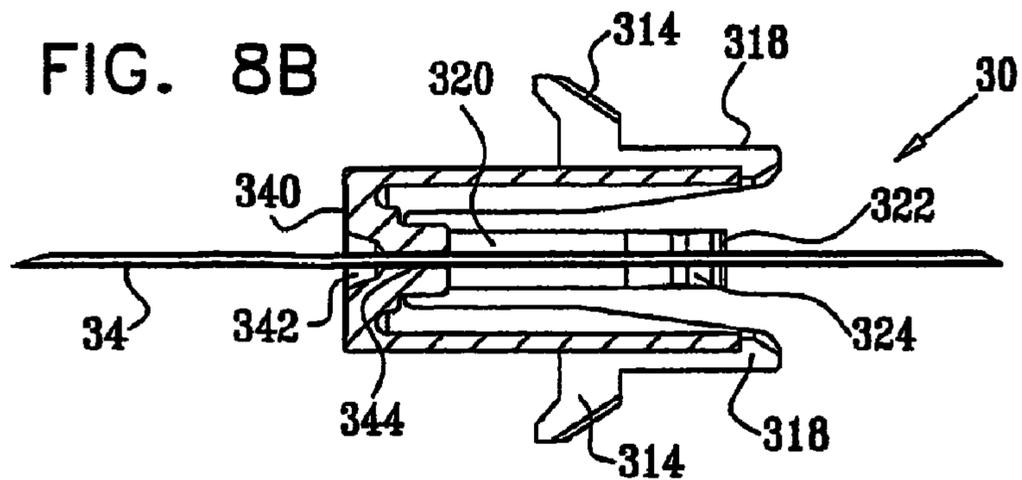
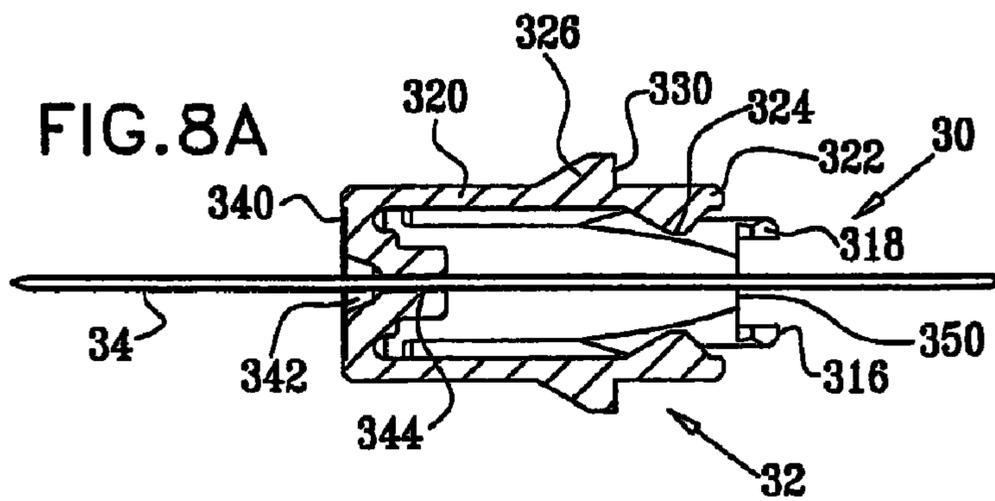
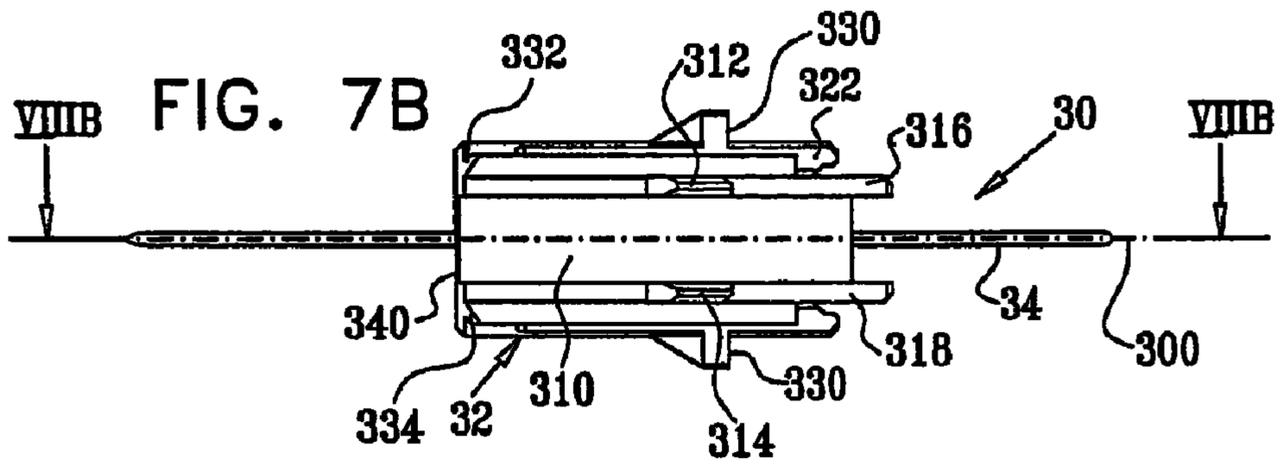
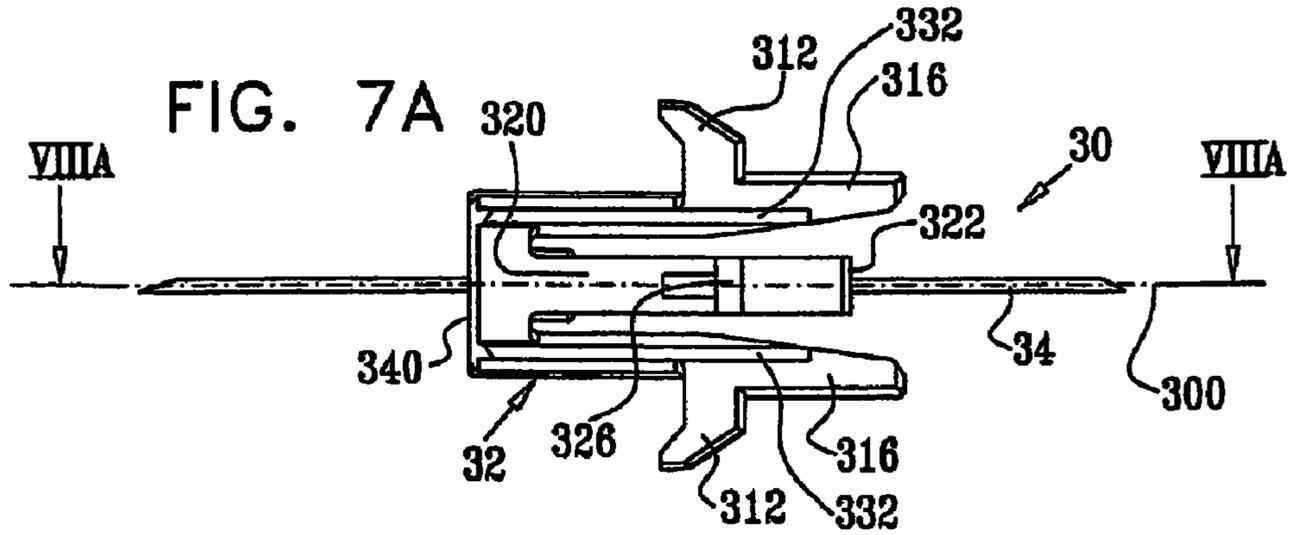






FIG. 11A

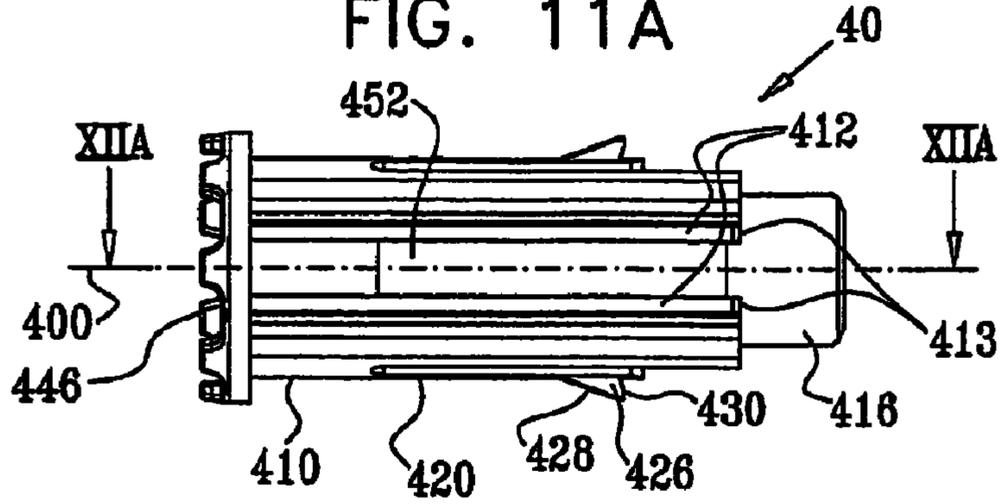


FIG. 11B

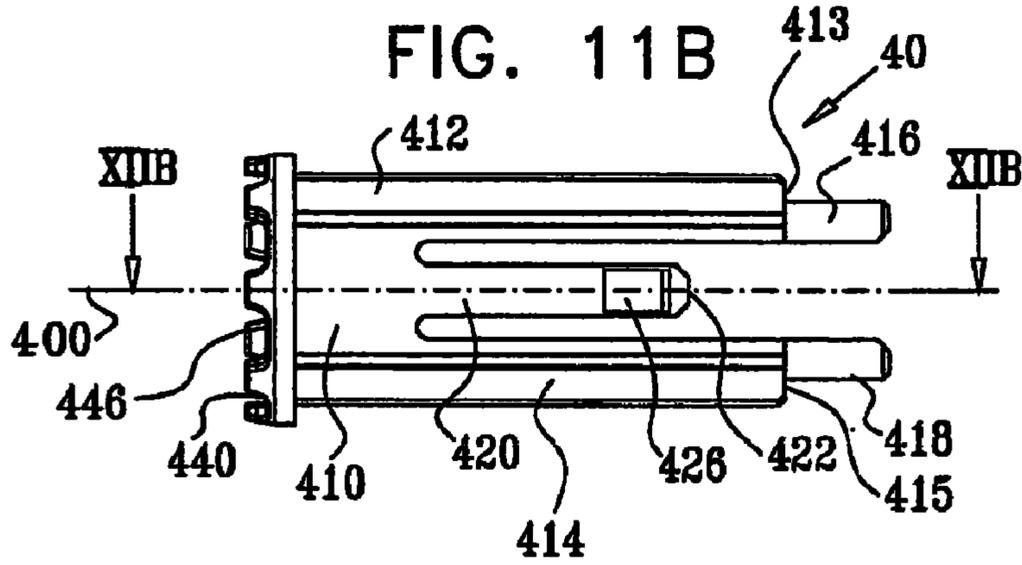


FIG. 12A

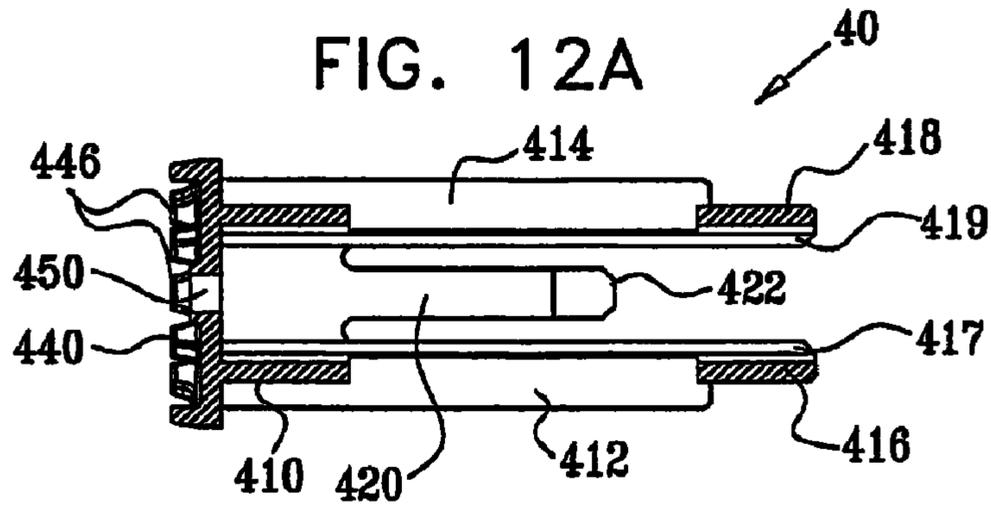
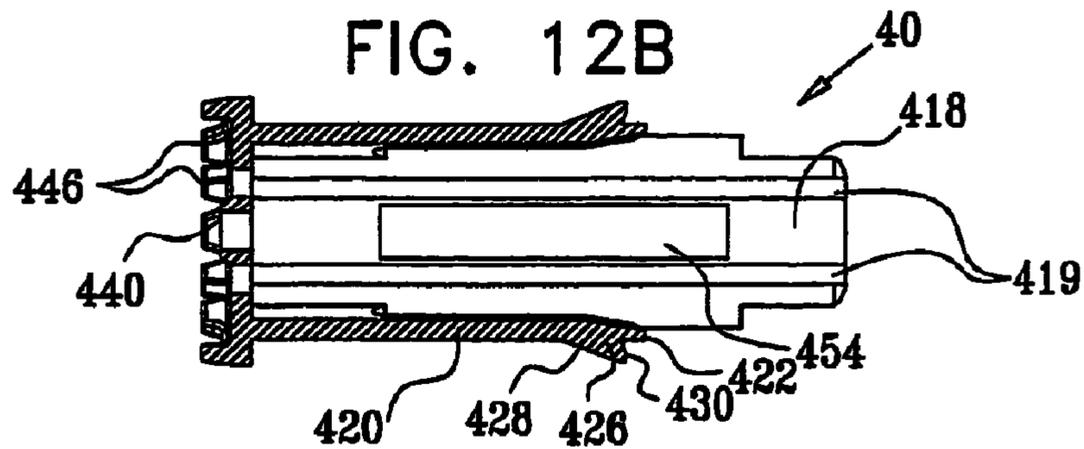


FIG. 12B



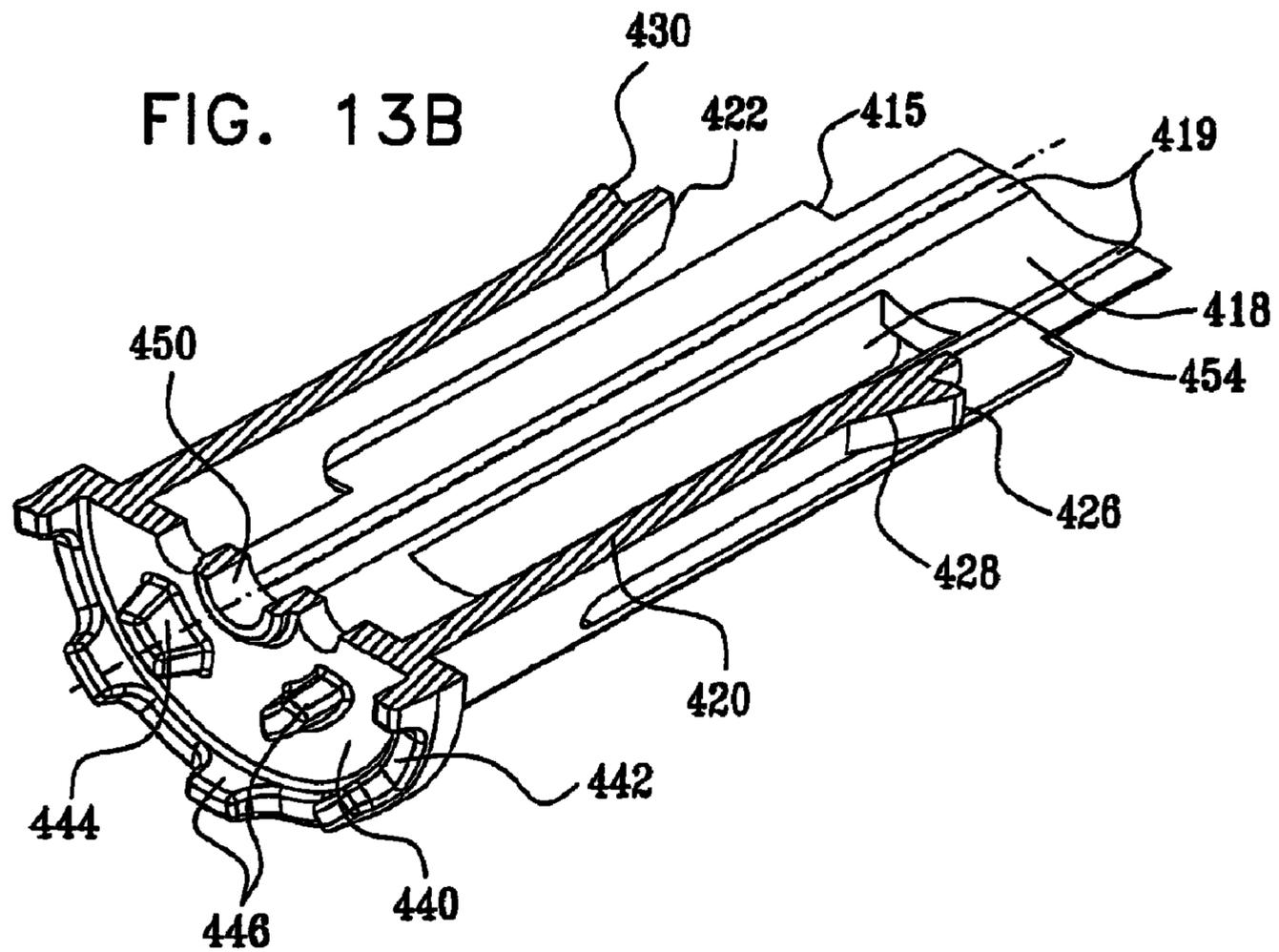
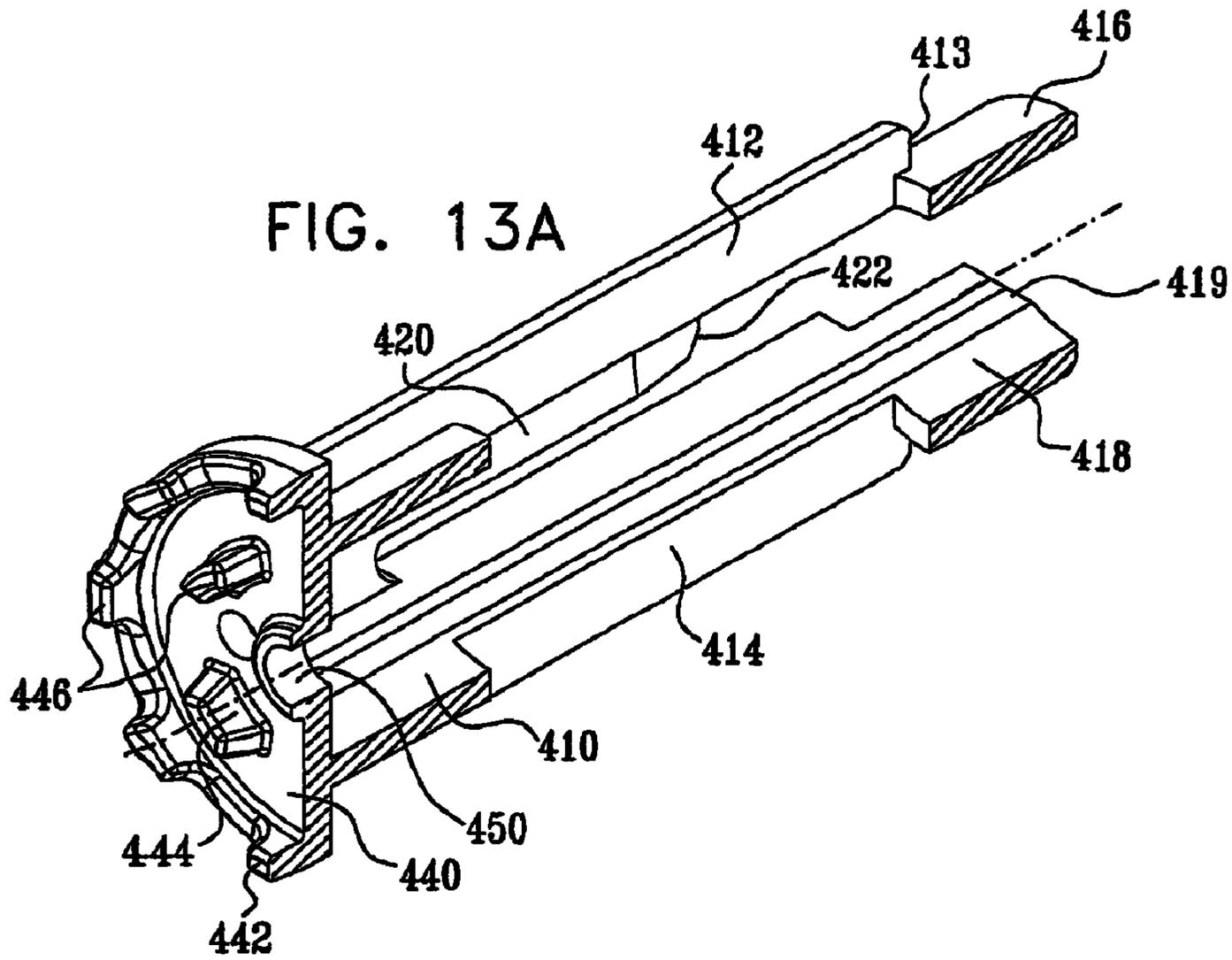


FIG. 14A

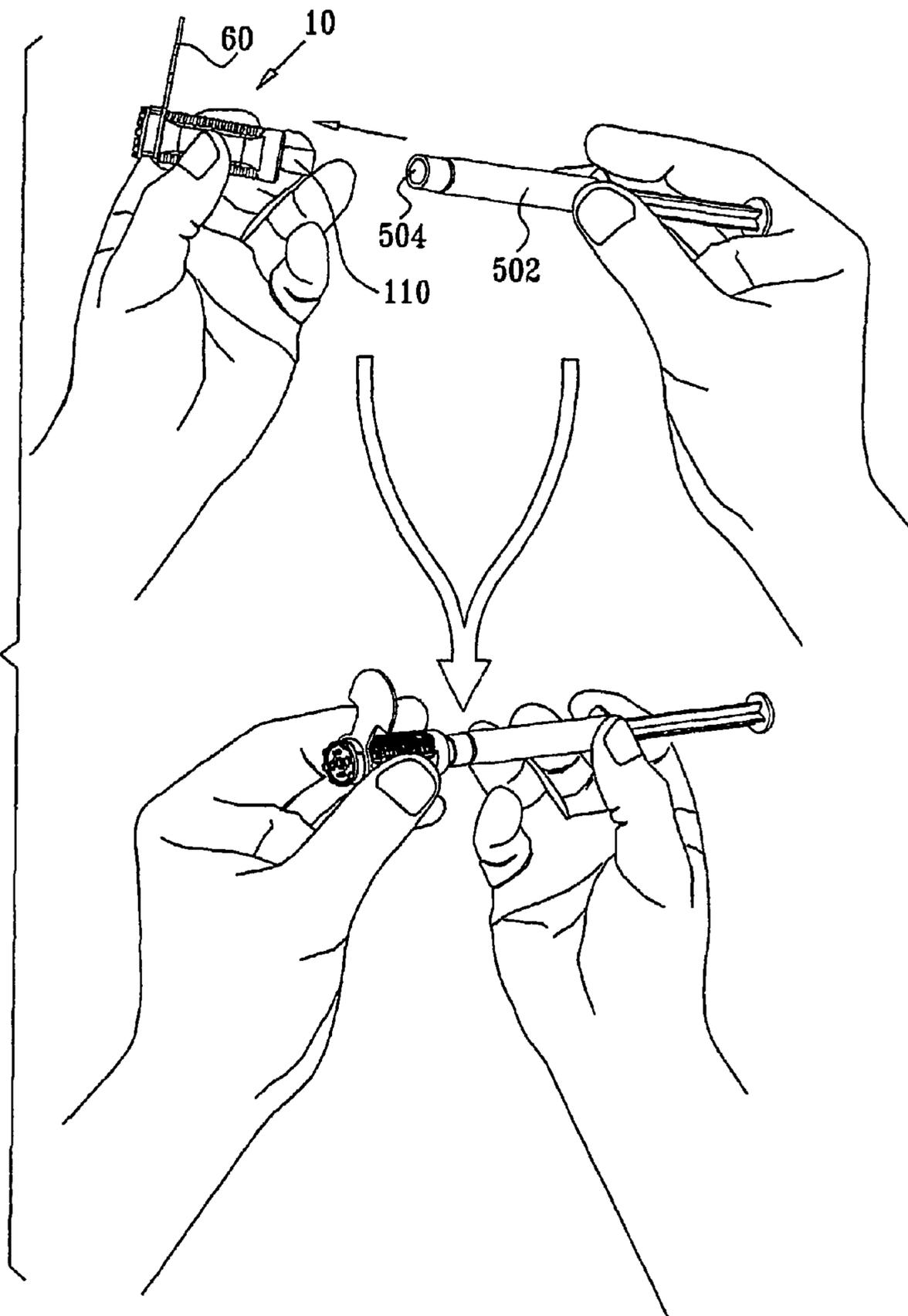
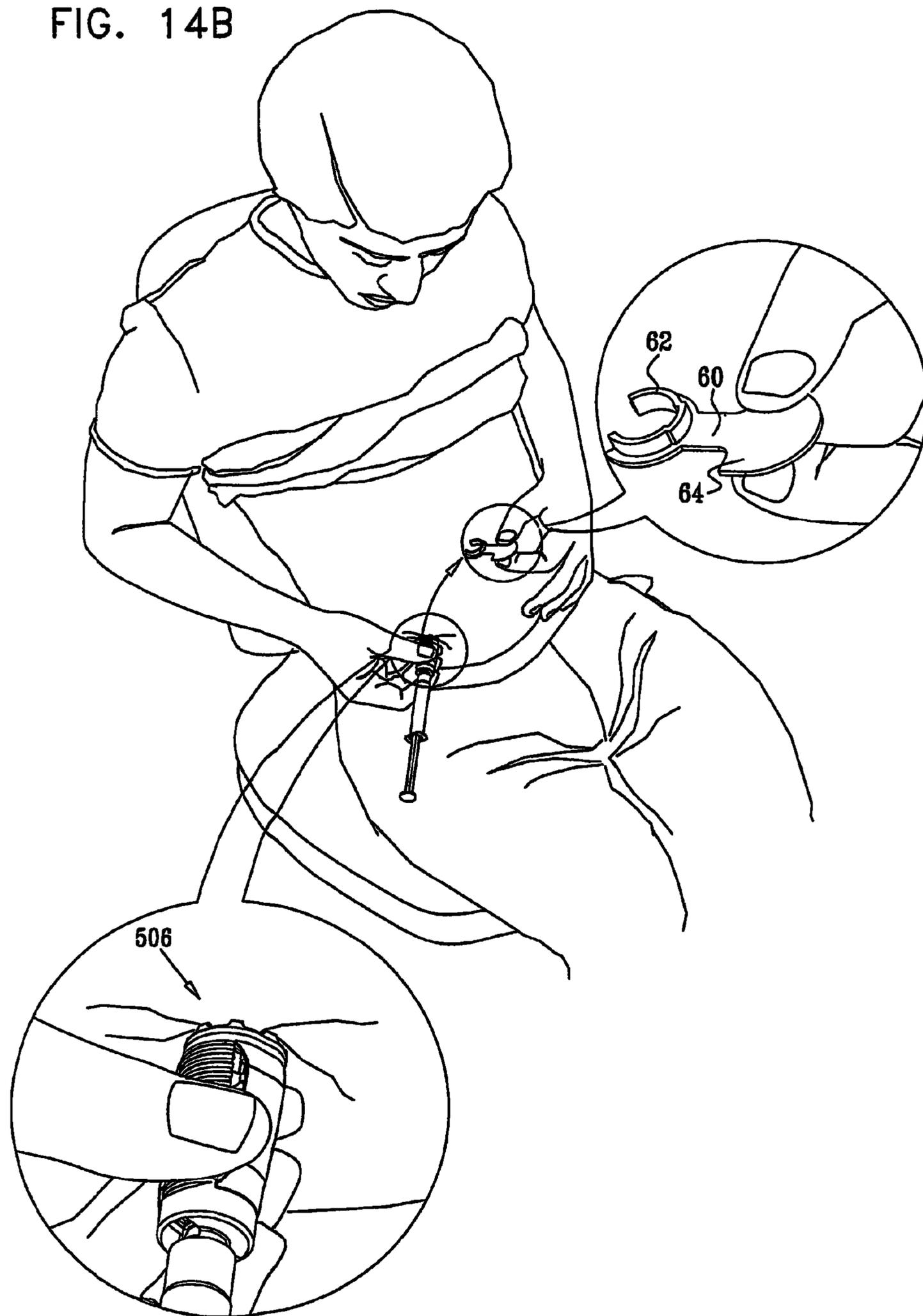
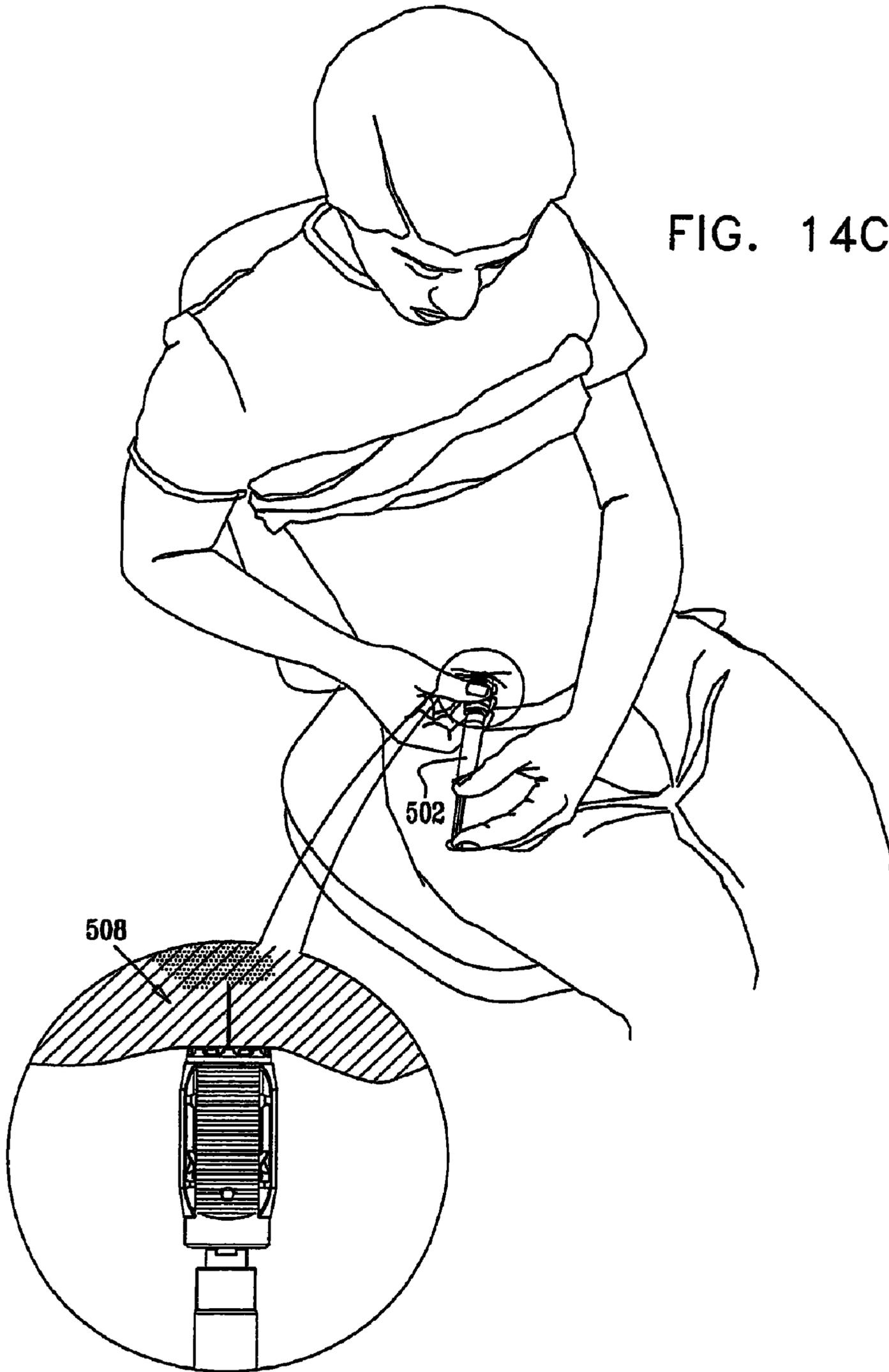


FIG. 14B





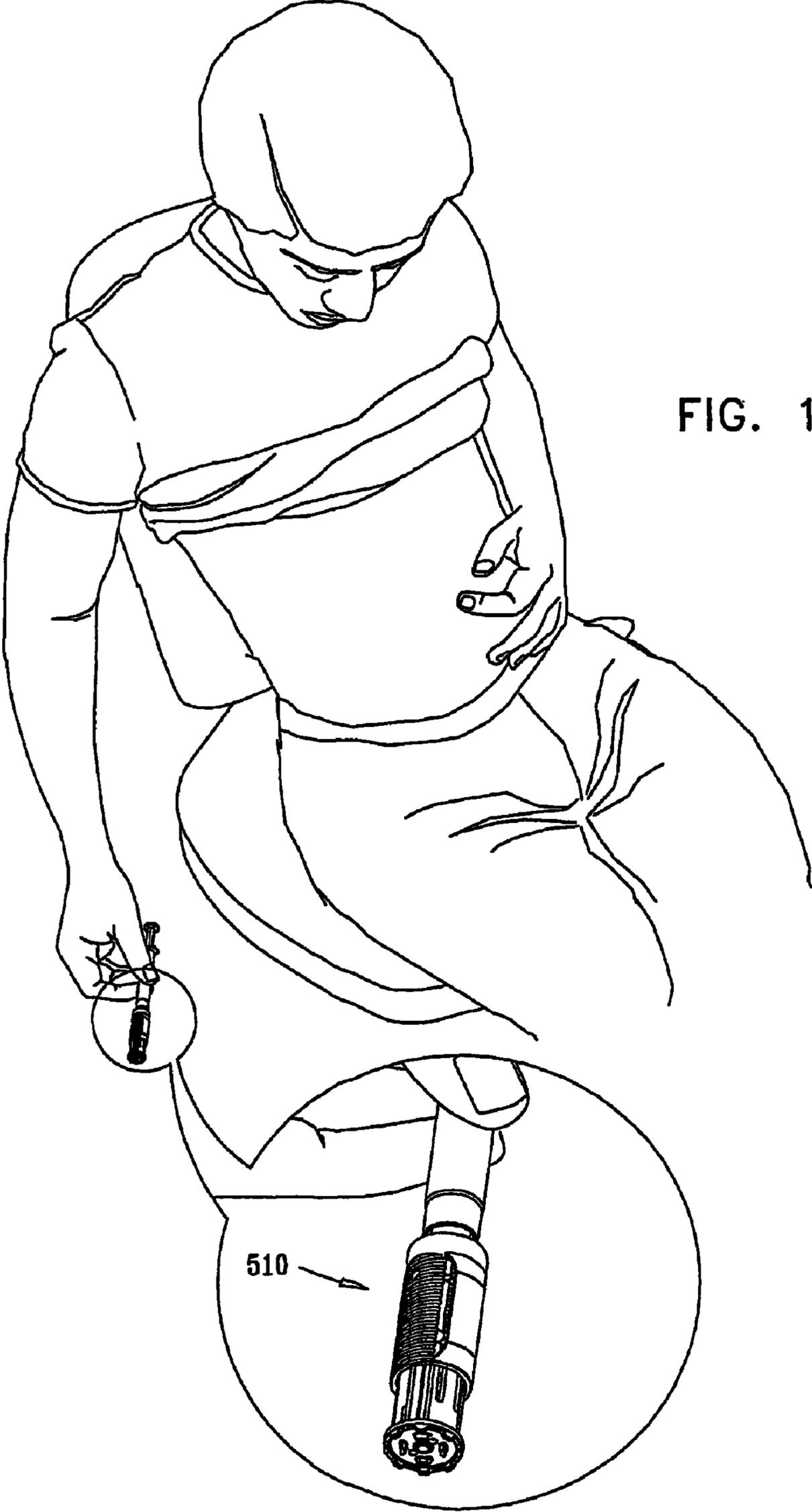


FIG. 14D

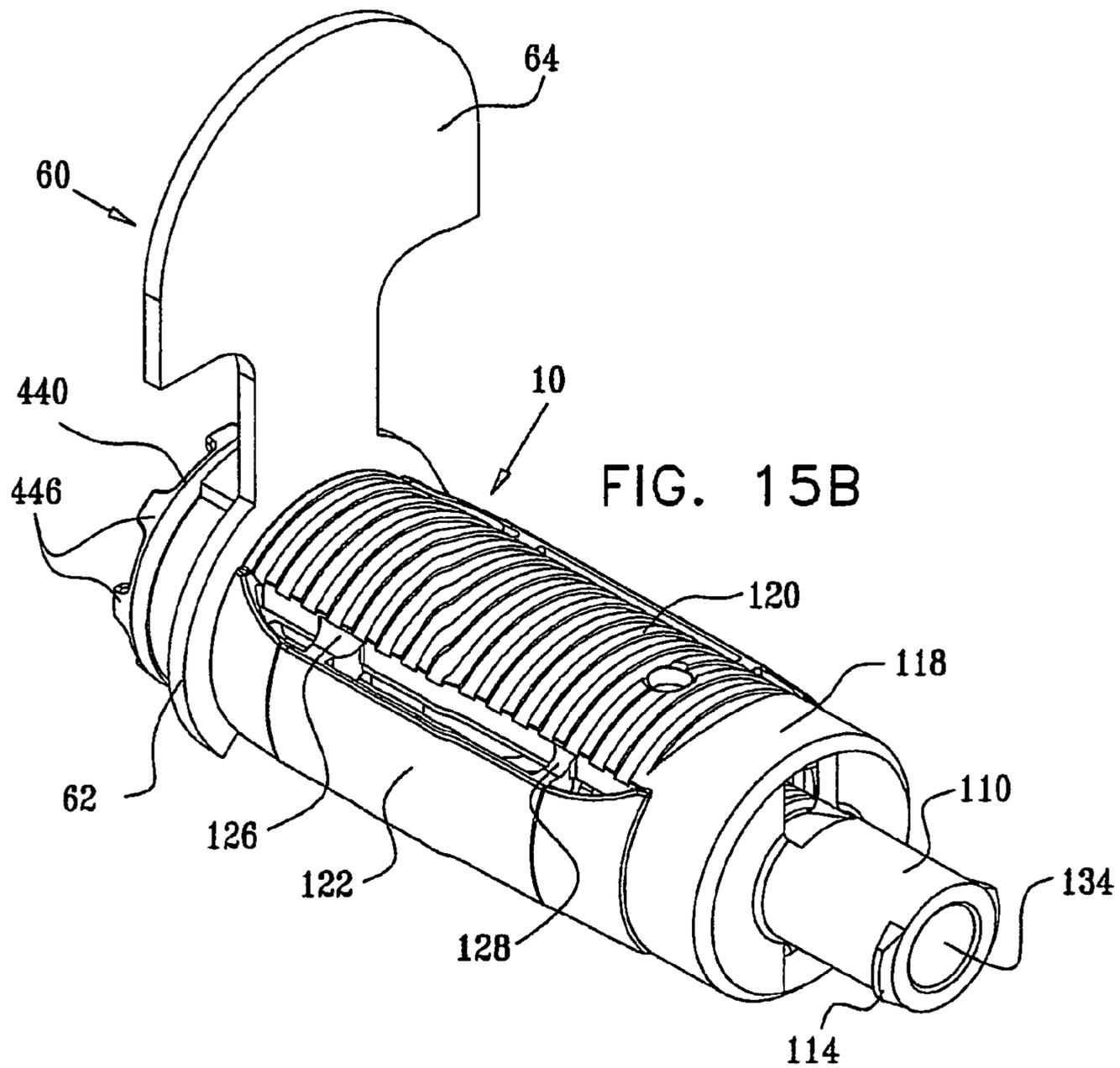
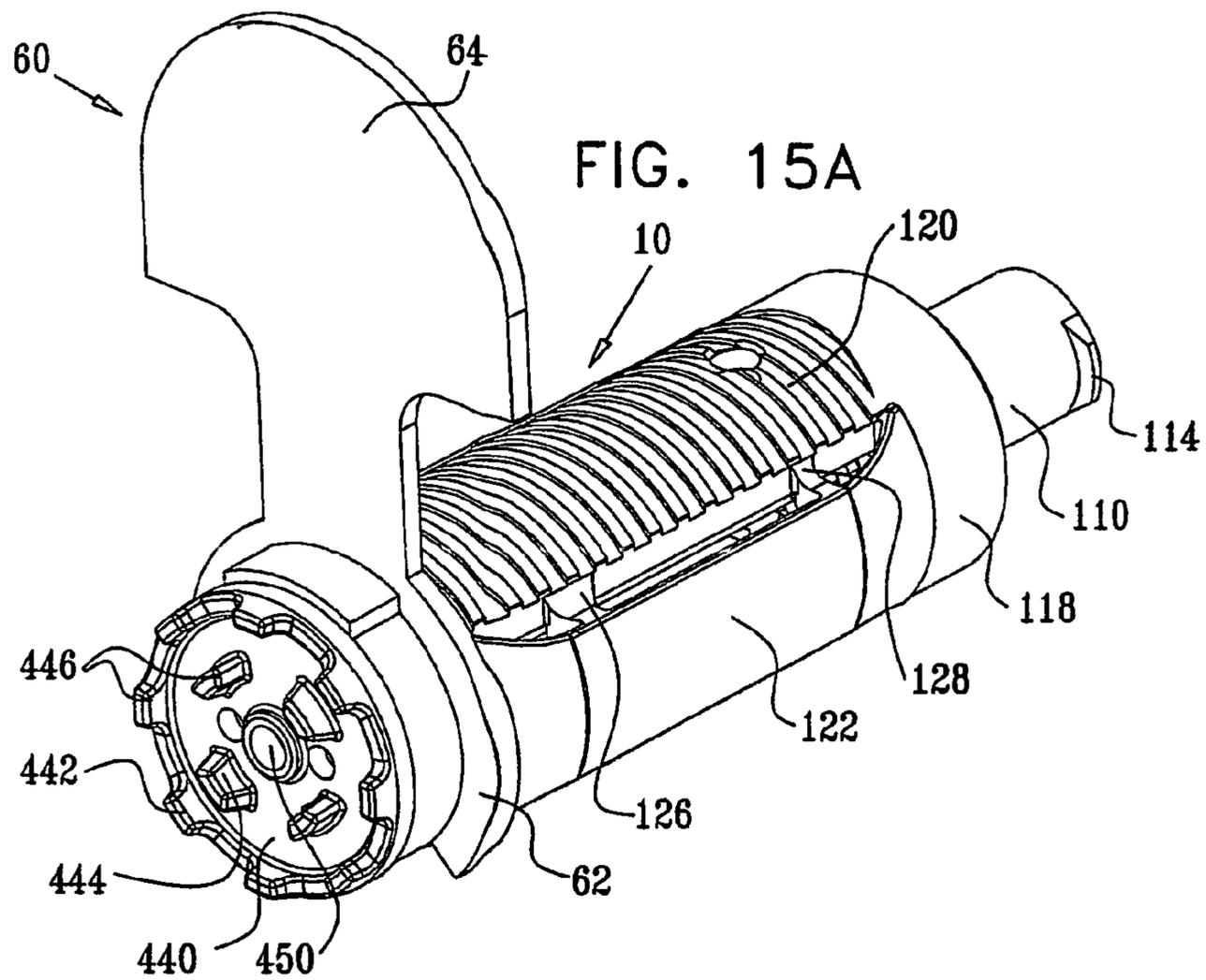


FIG. 16A

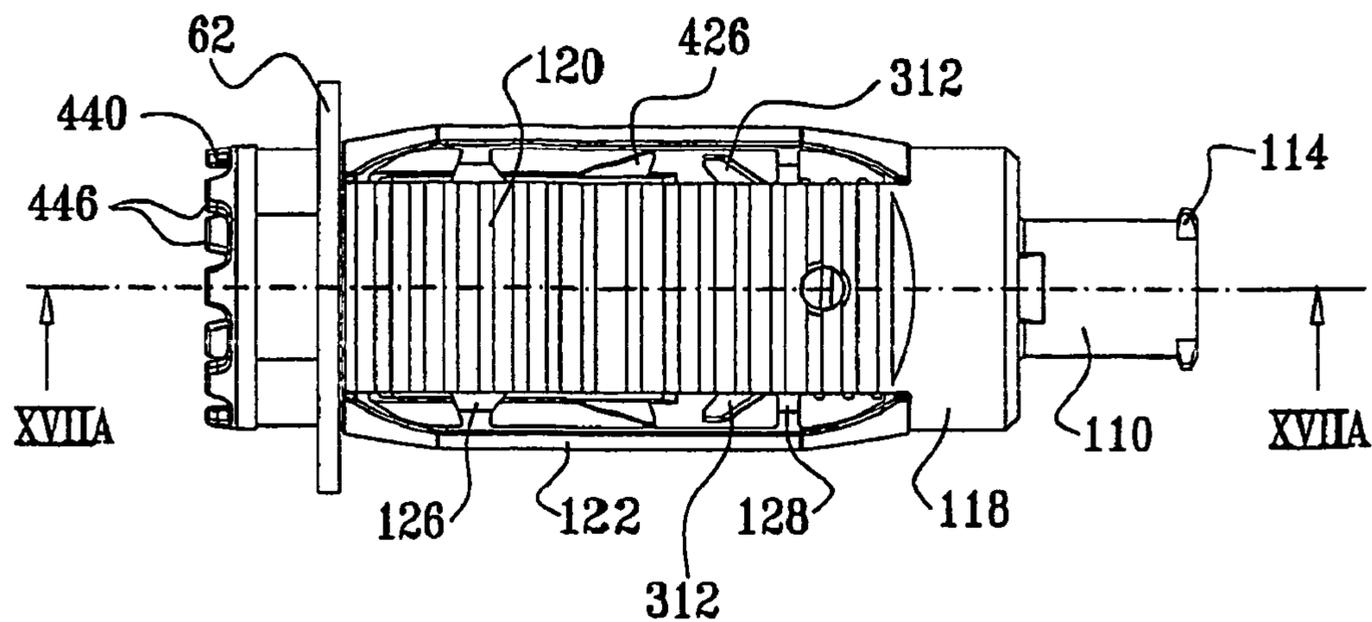
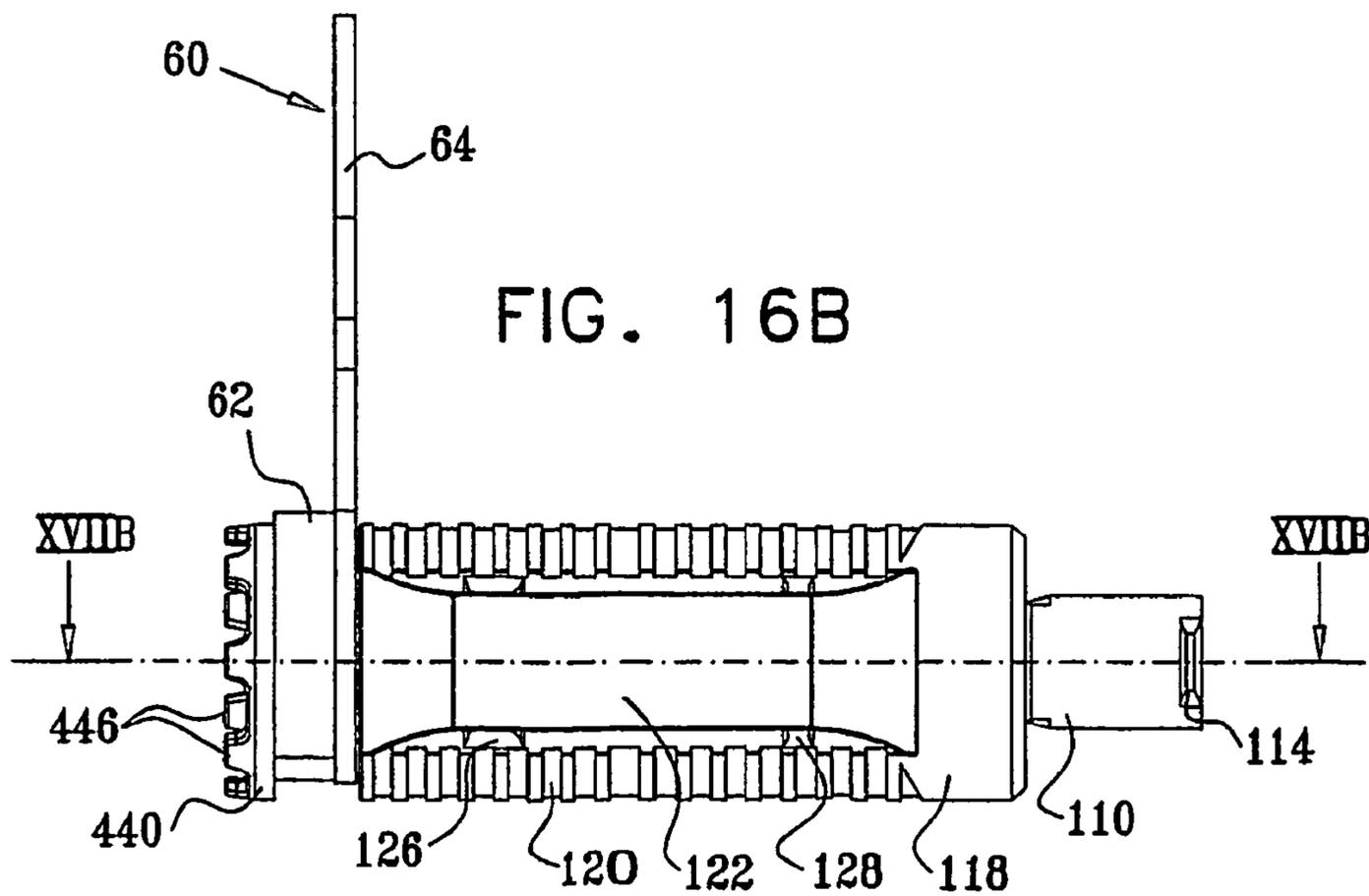
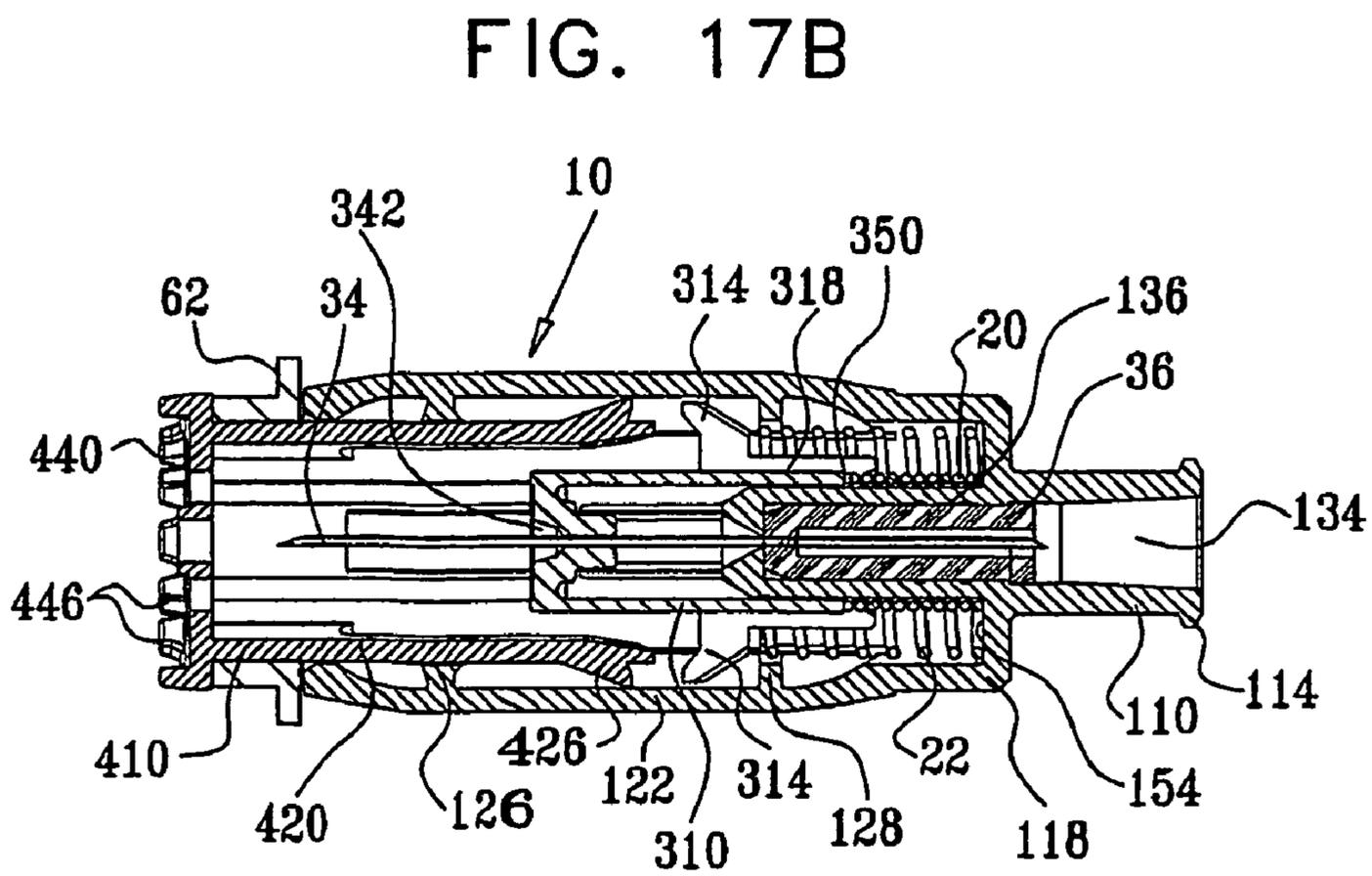
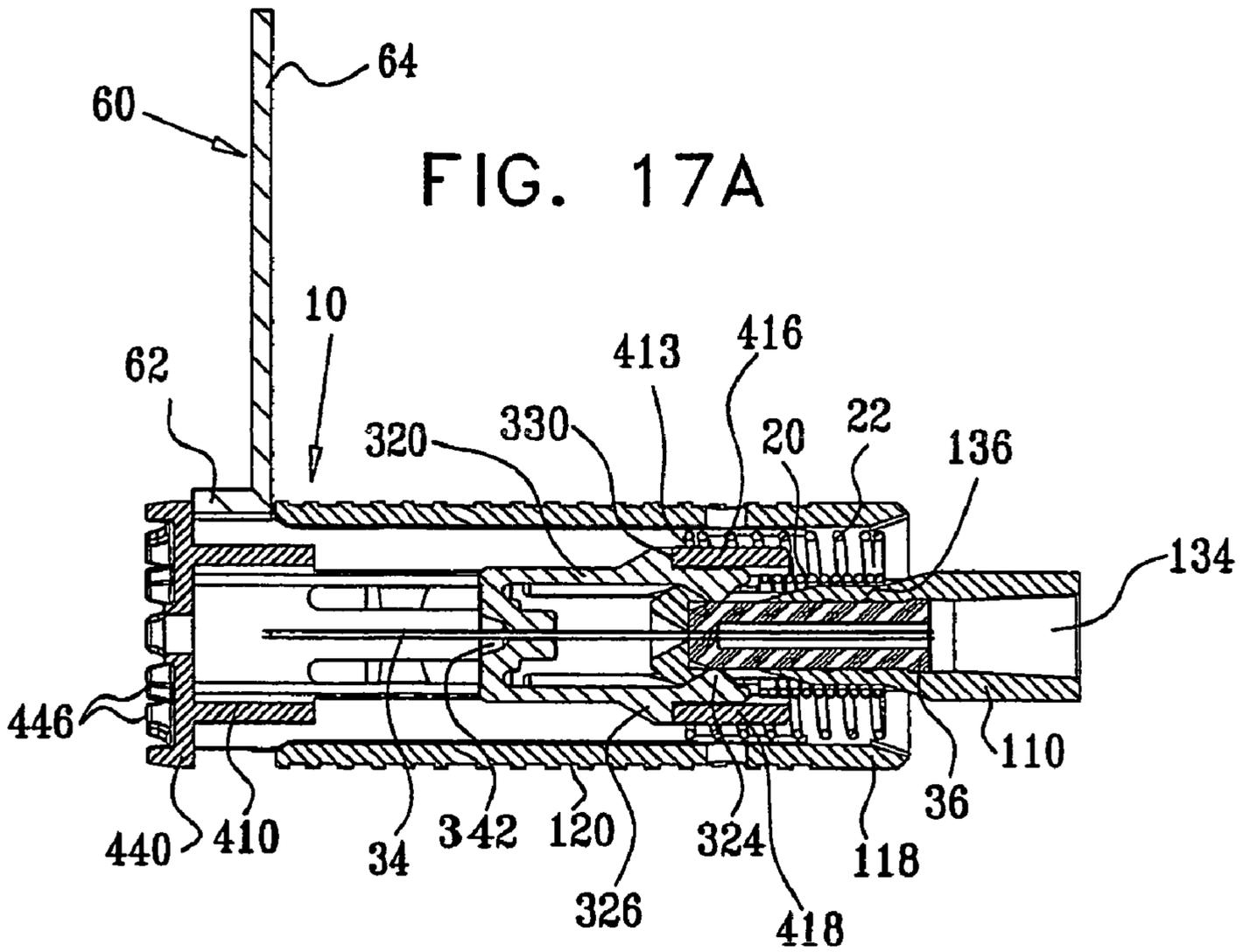


FIG. 16B





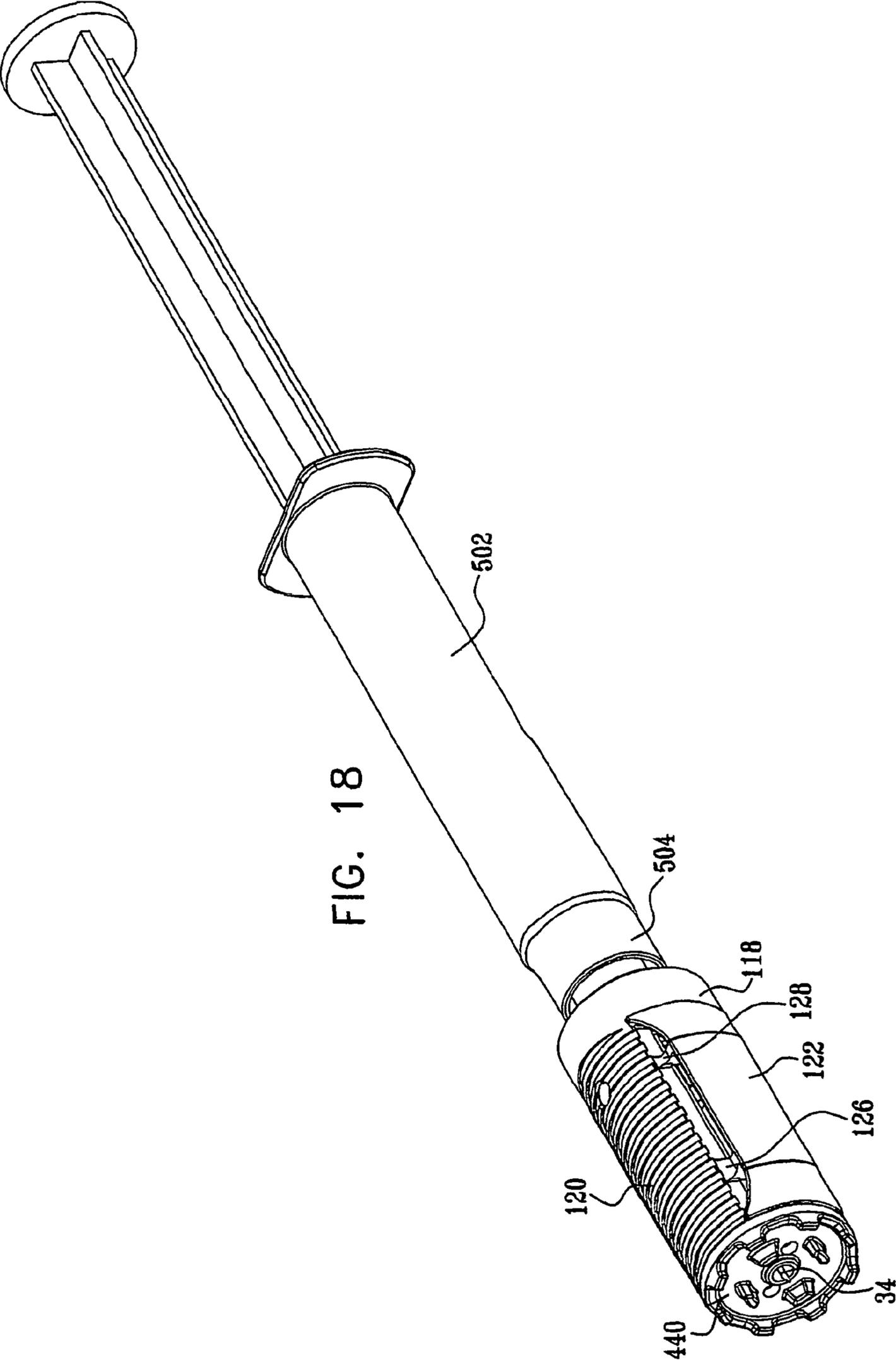
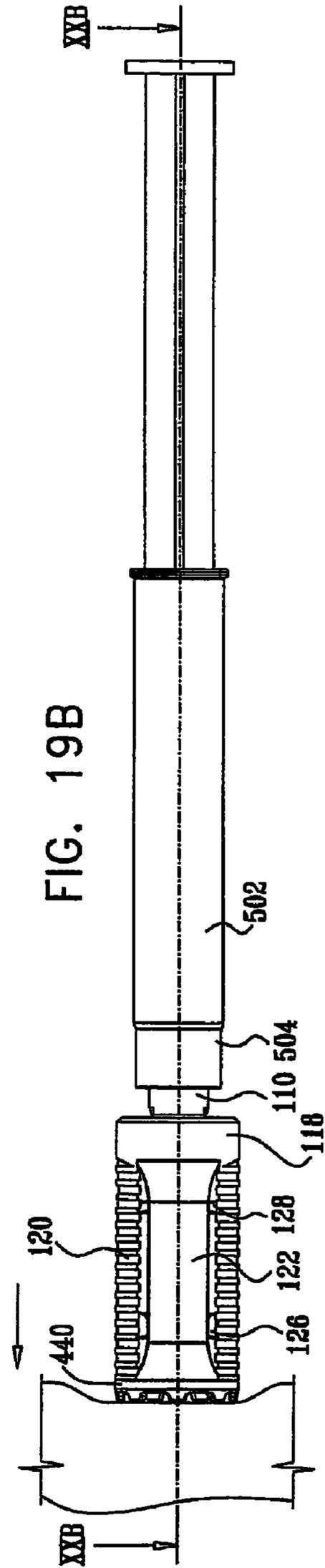
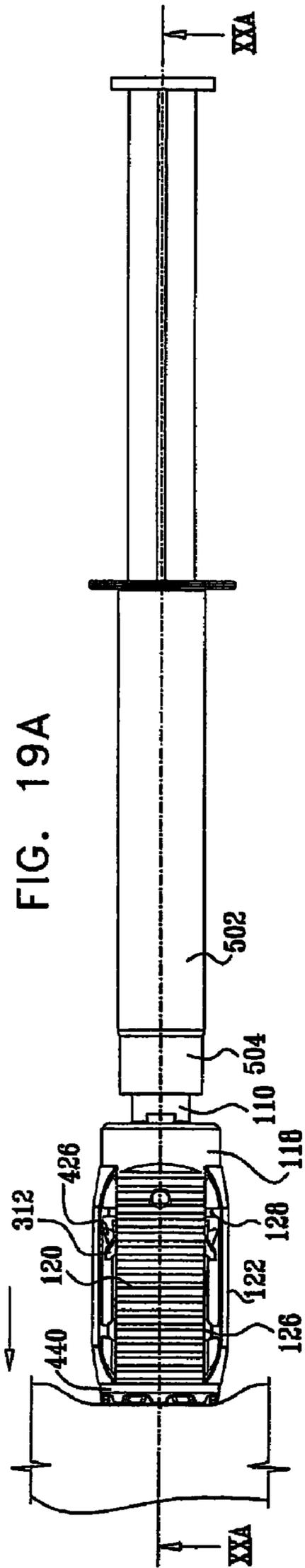
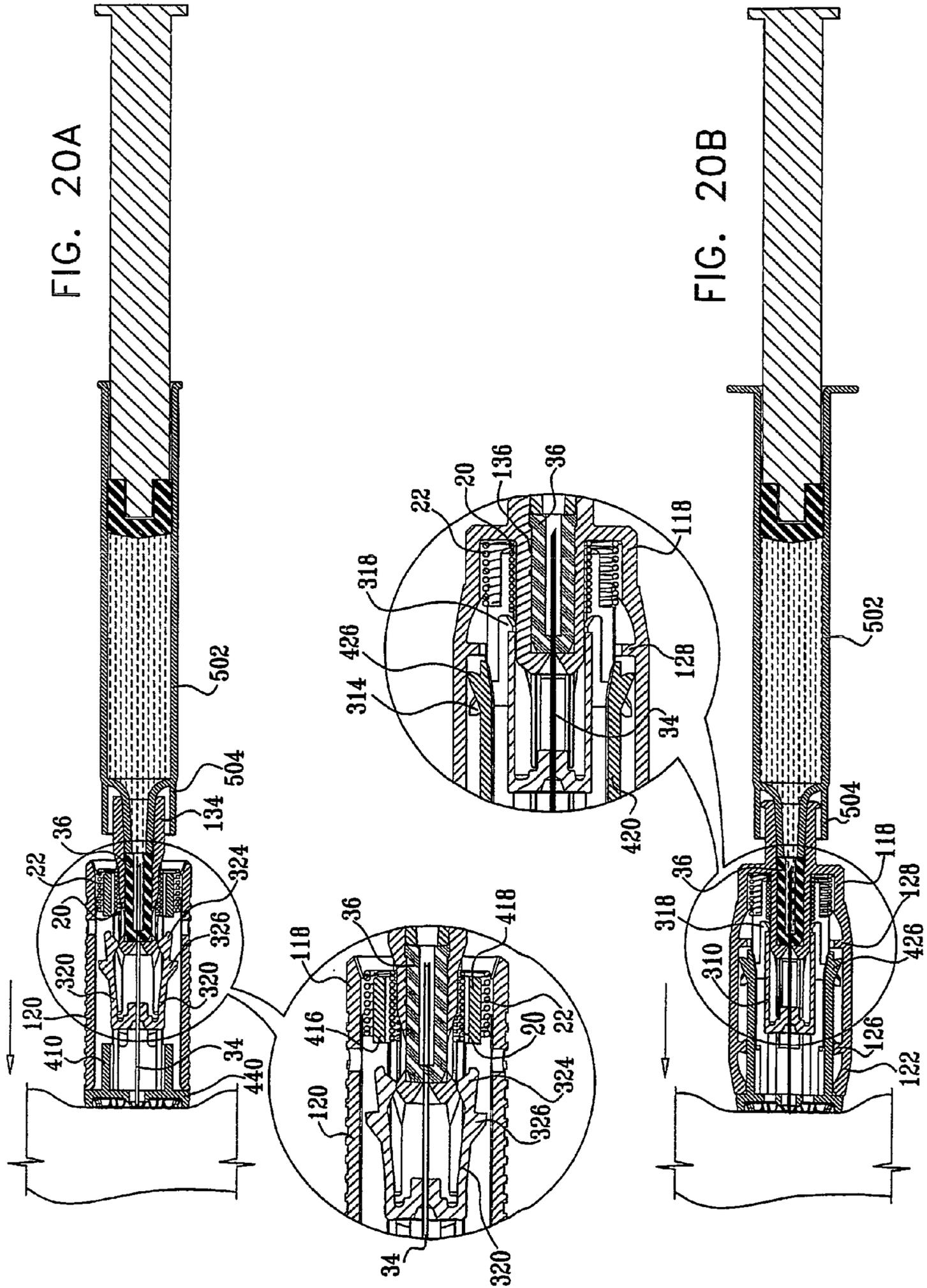
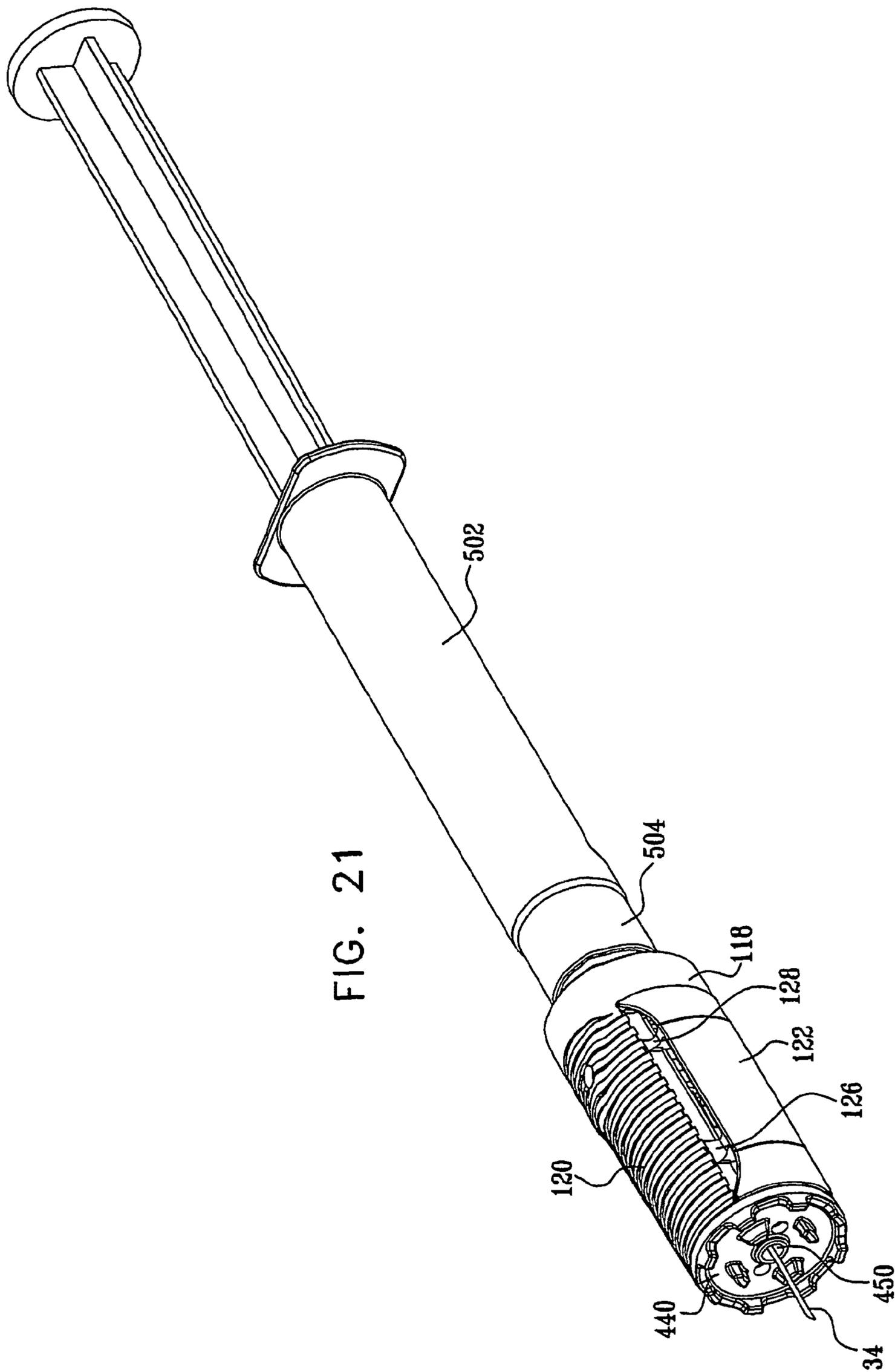
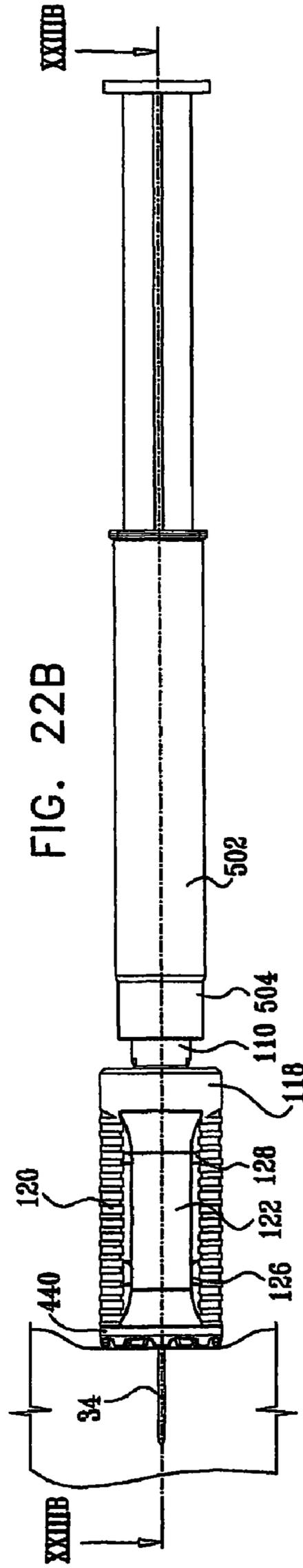
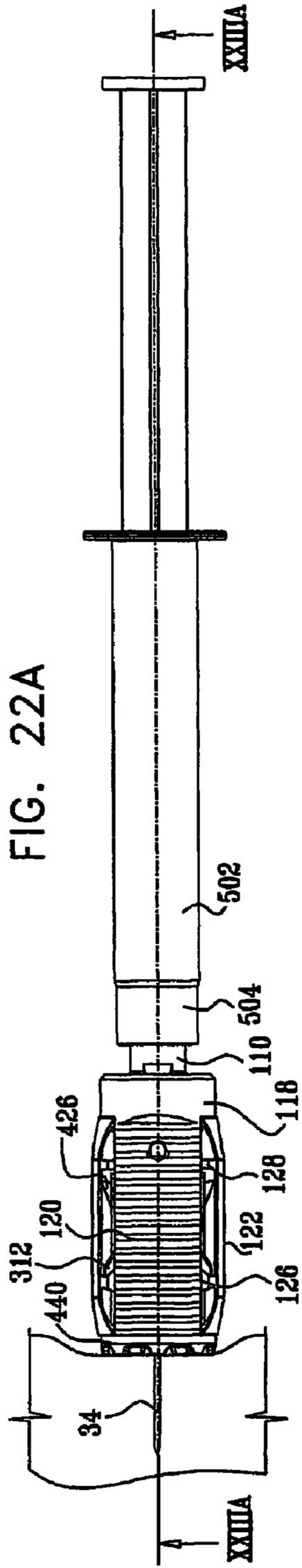


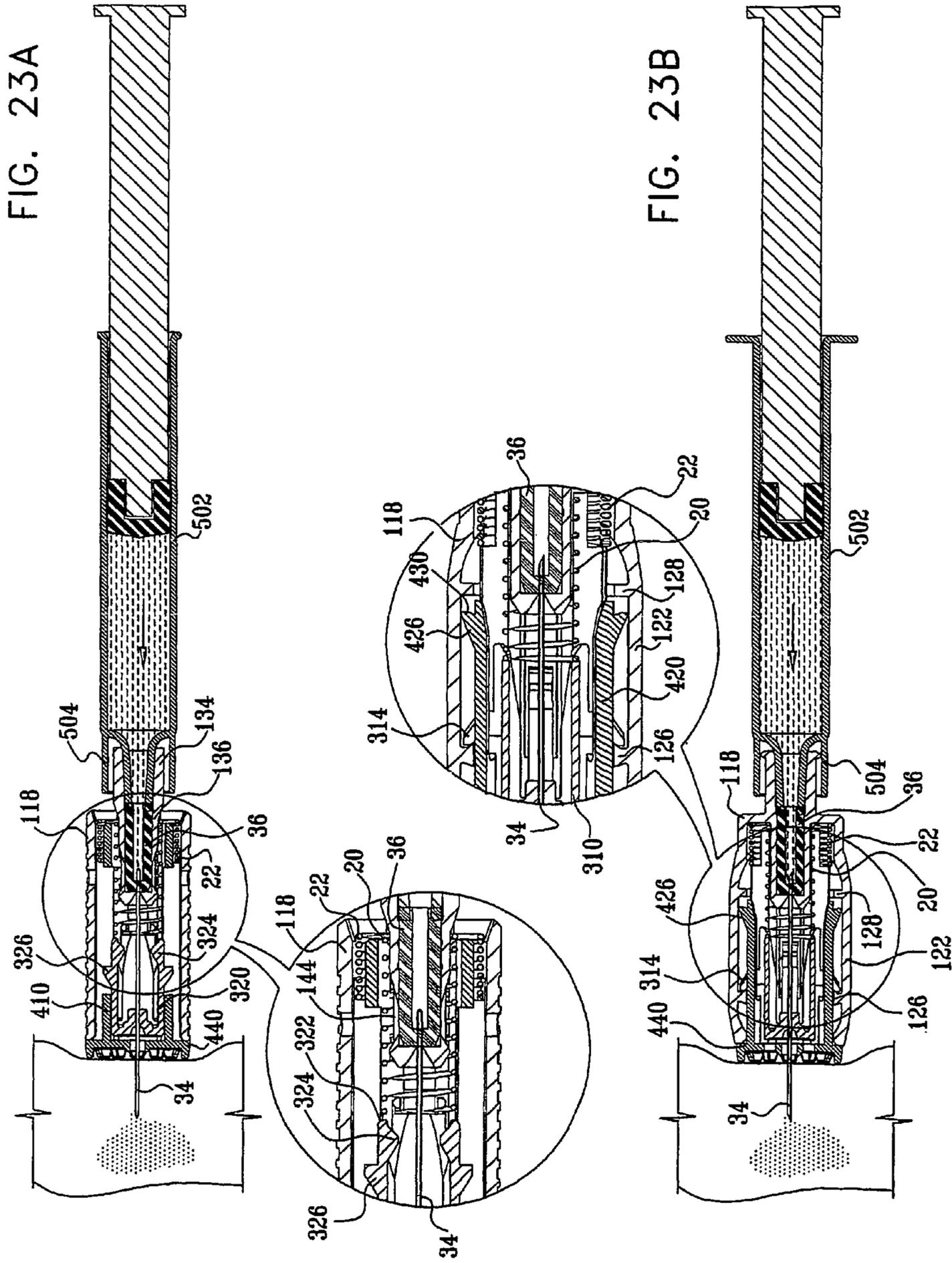
FIG. 18











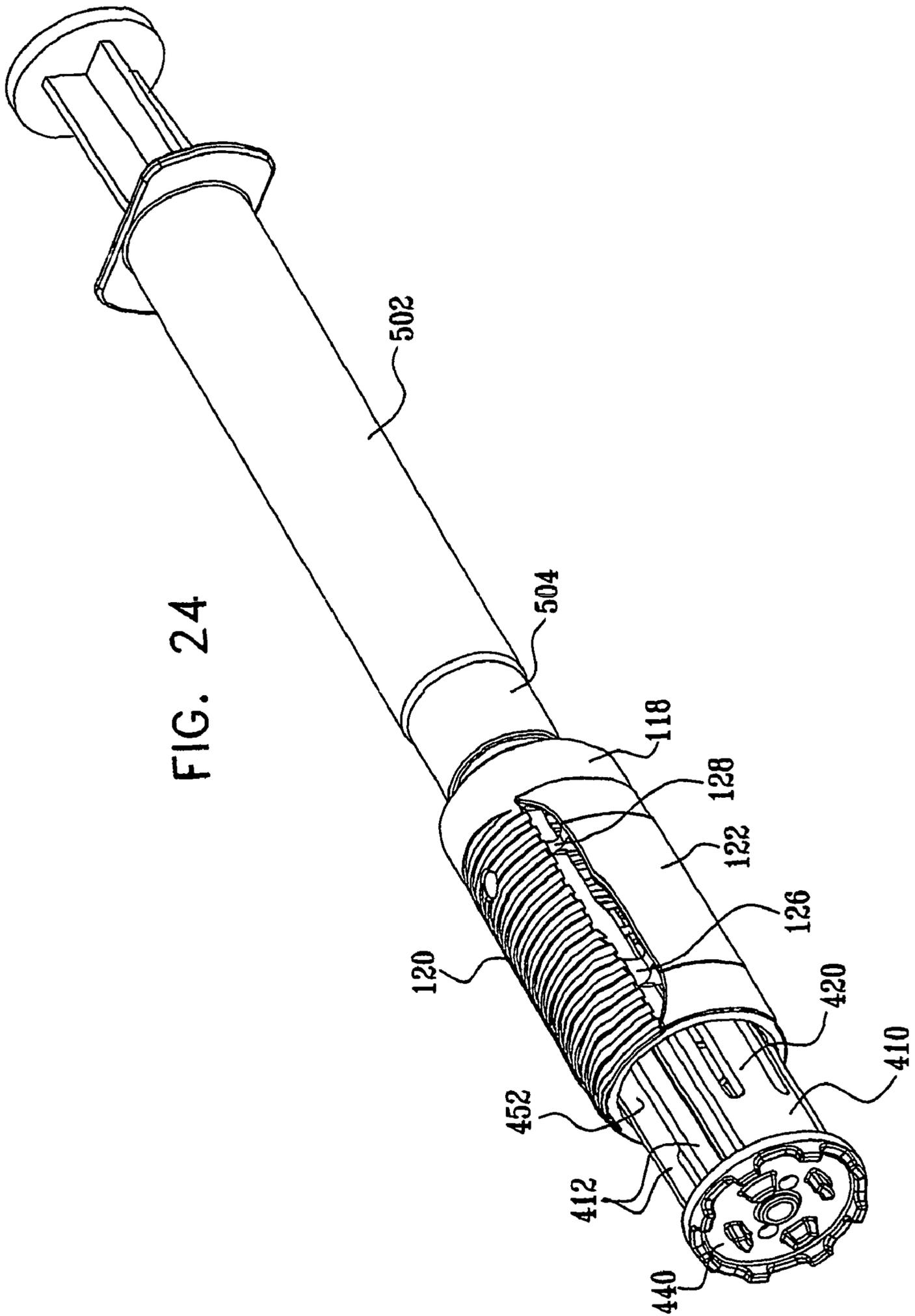
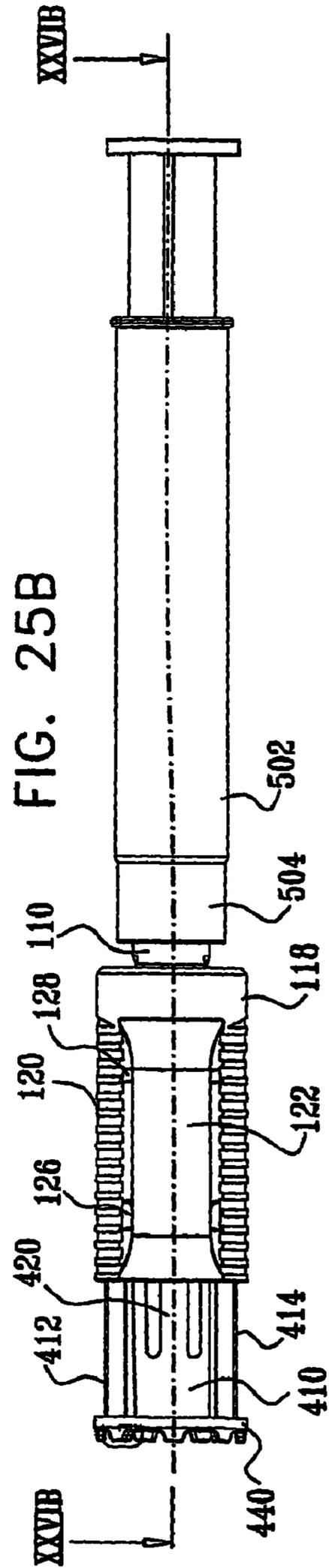
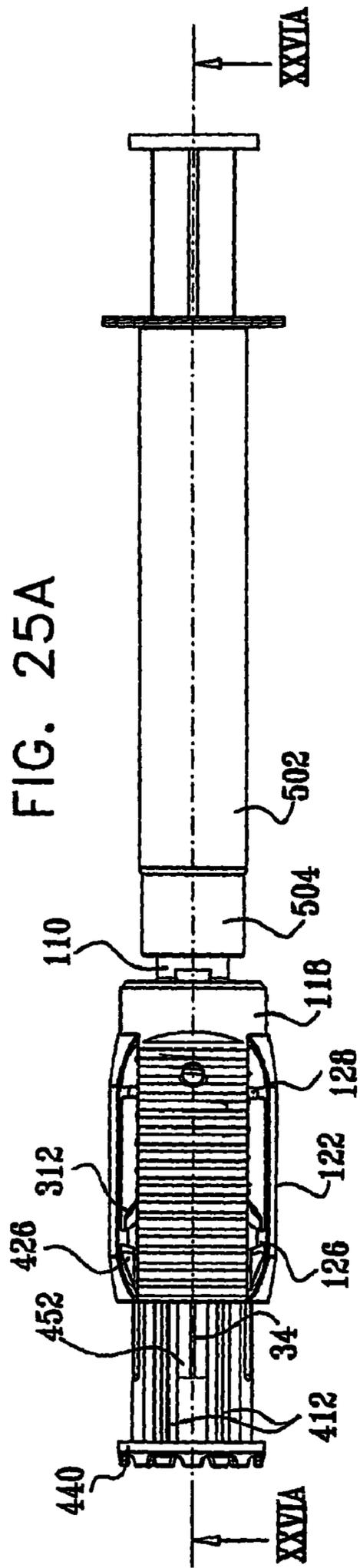
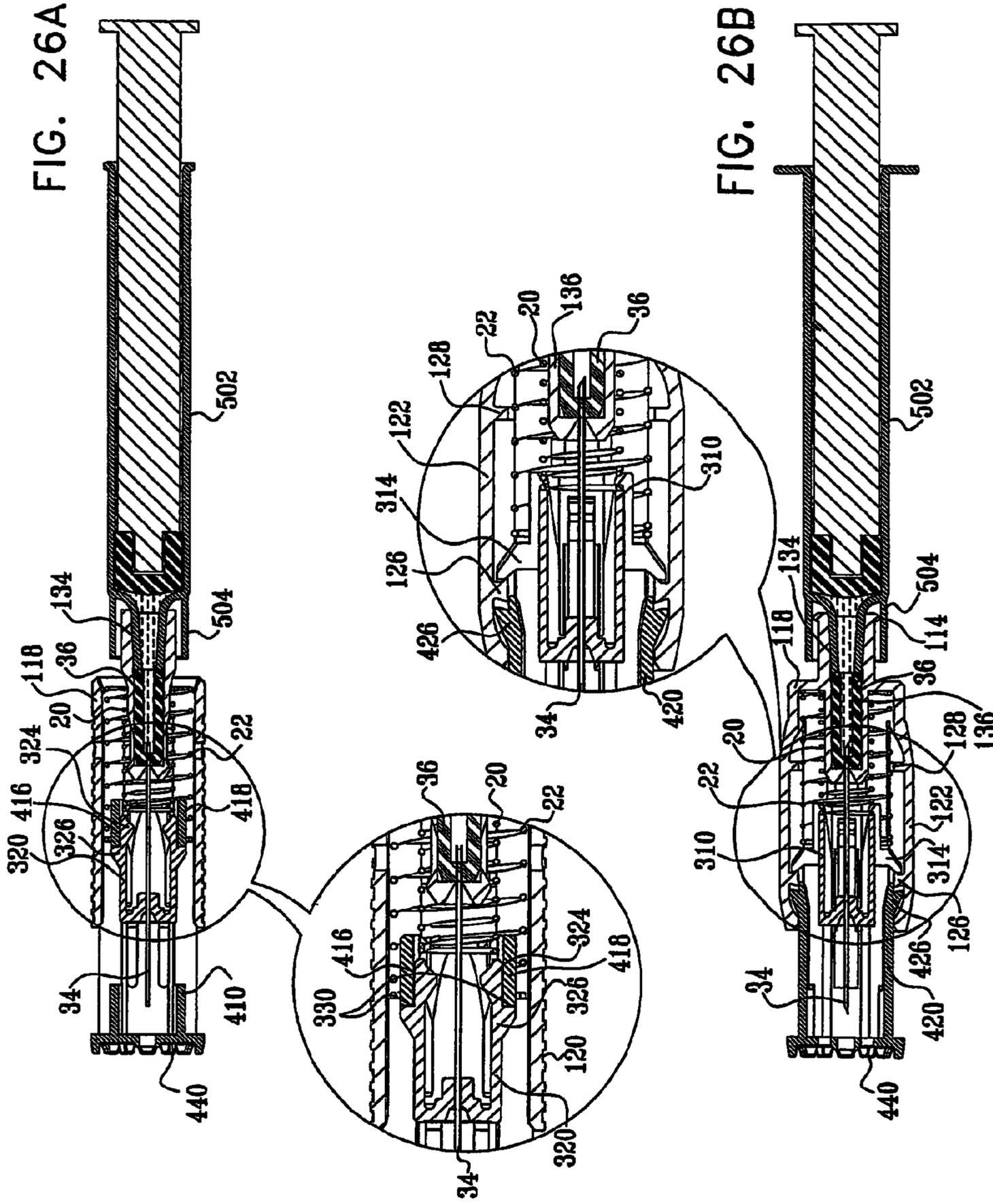


FIG. 24





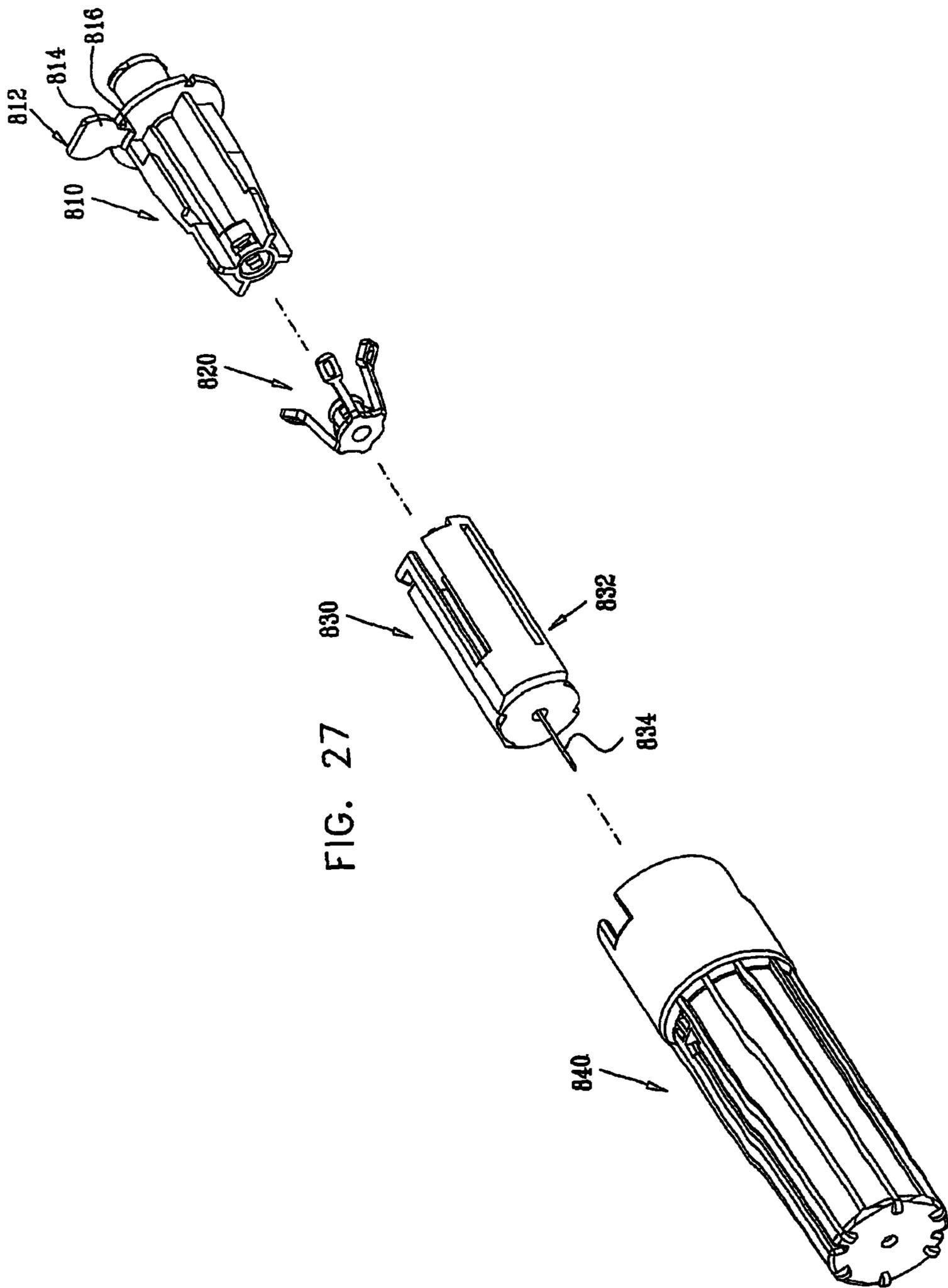


FIG. 27

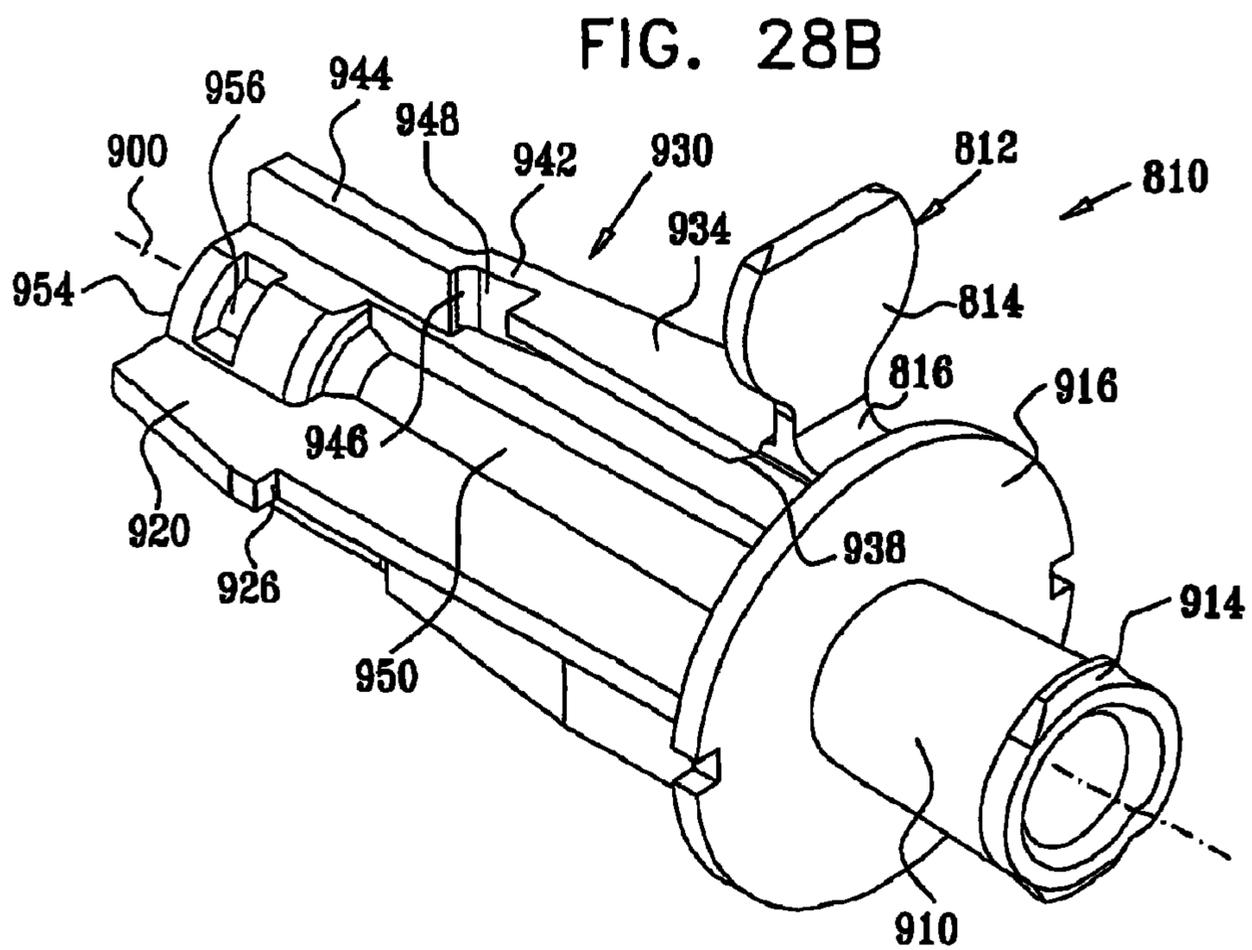
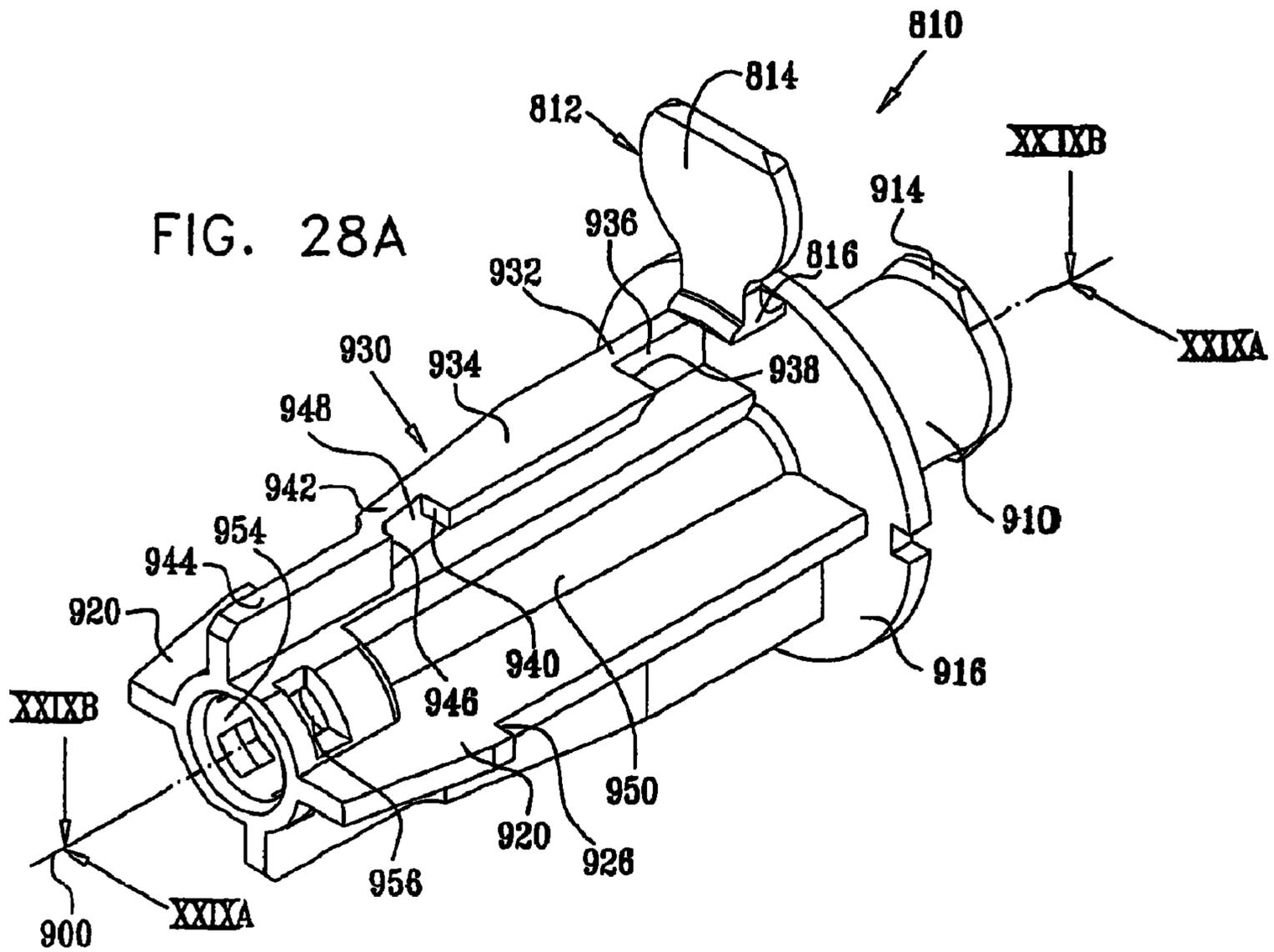


FIG. 29A

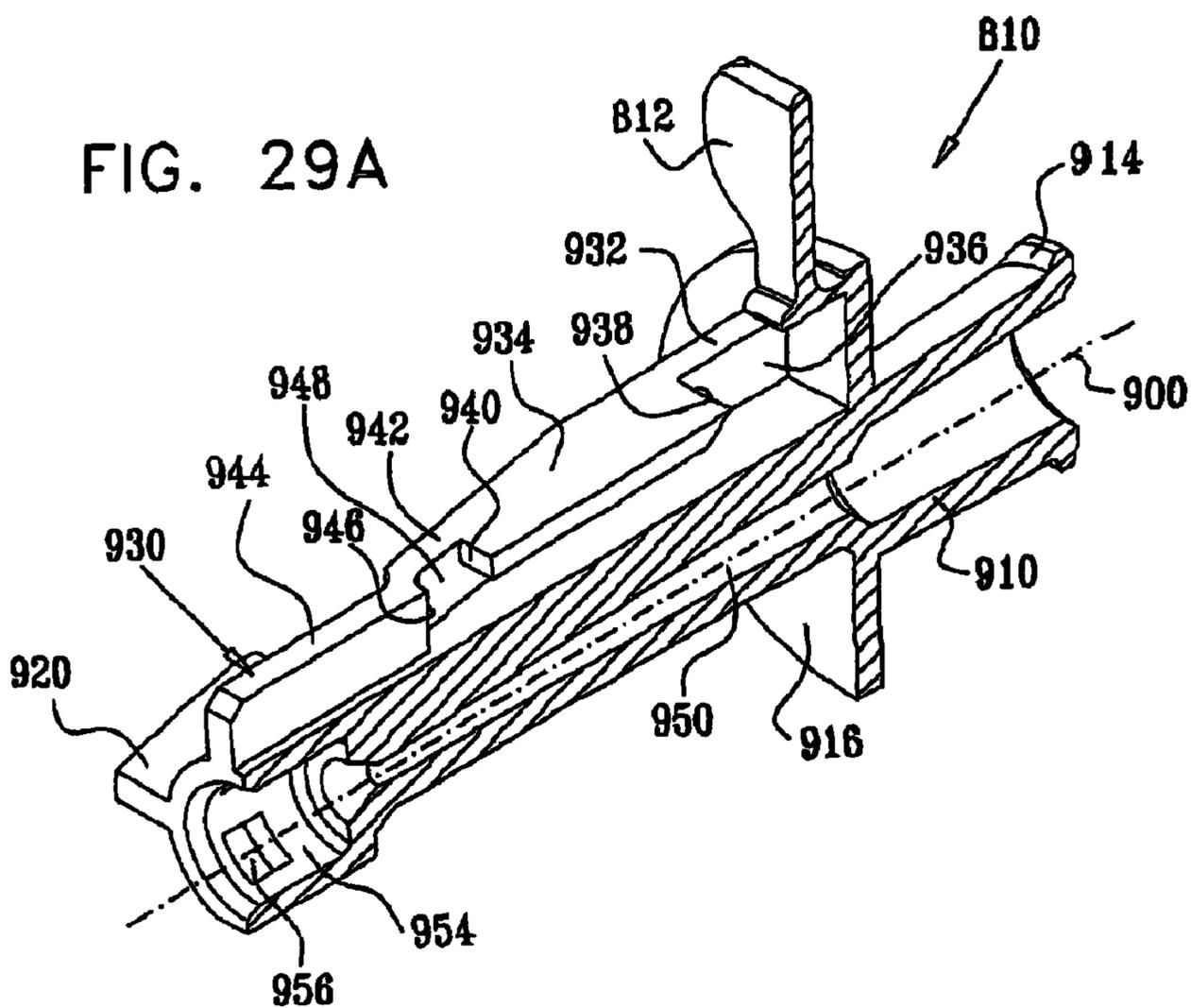
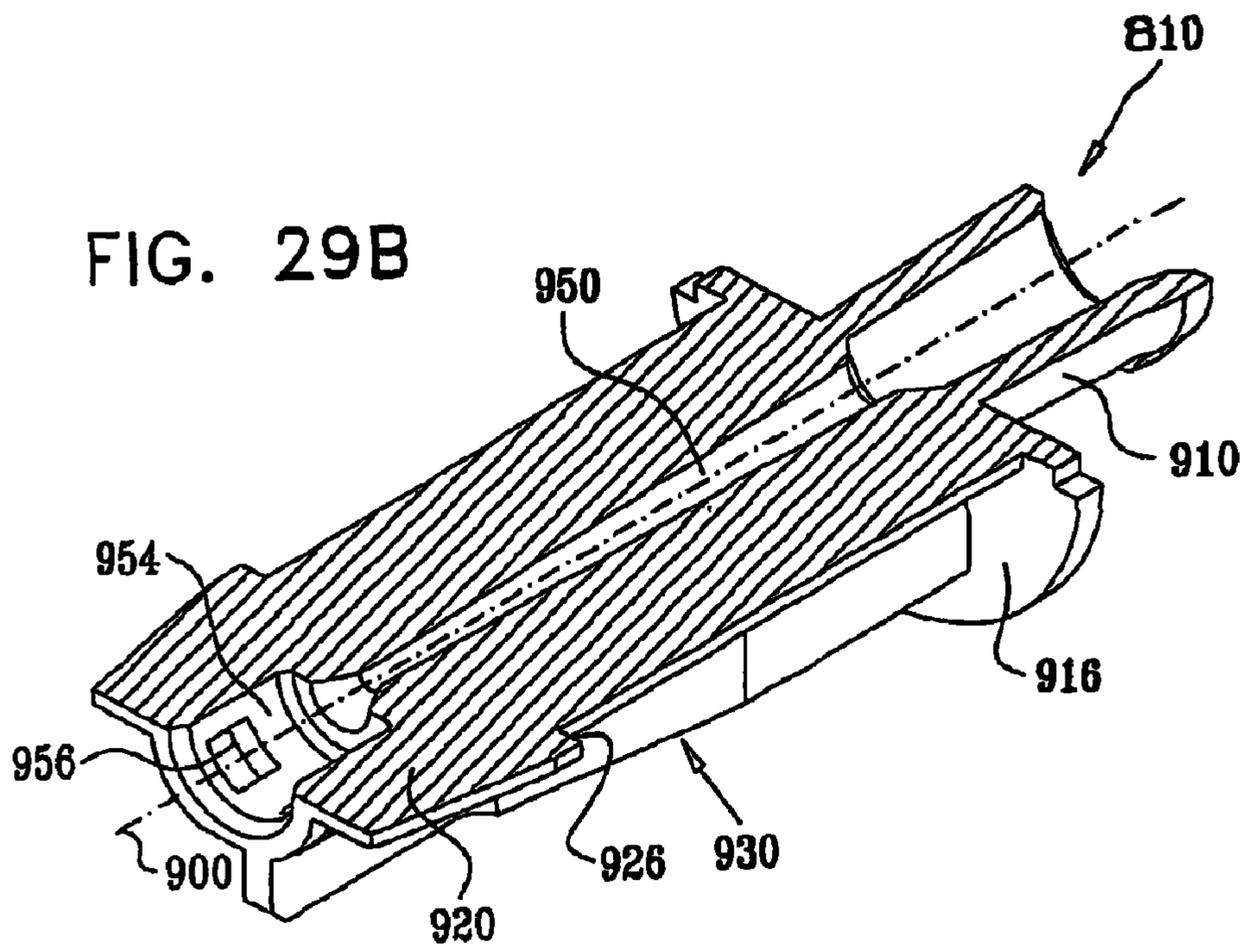
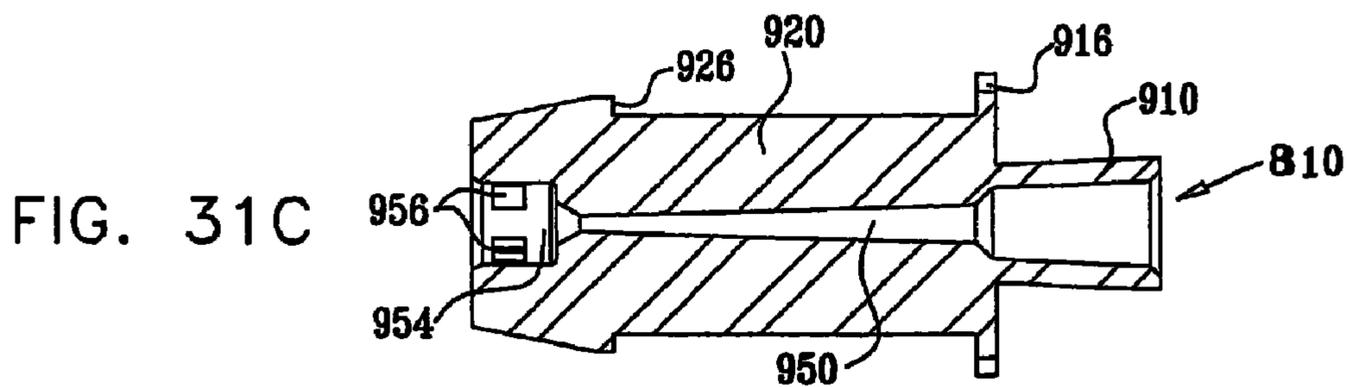
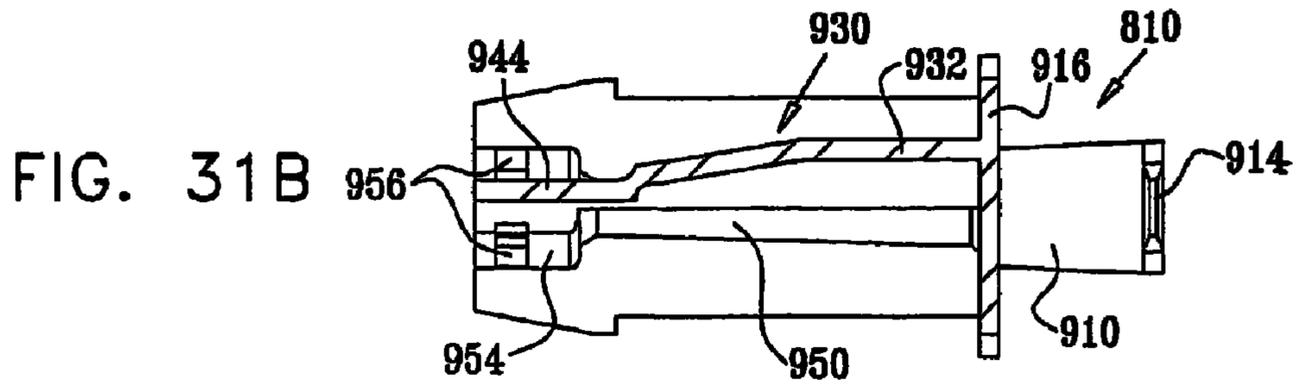
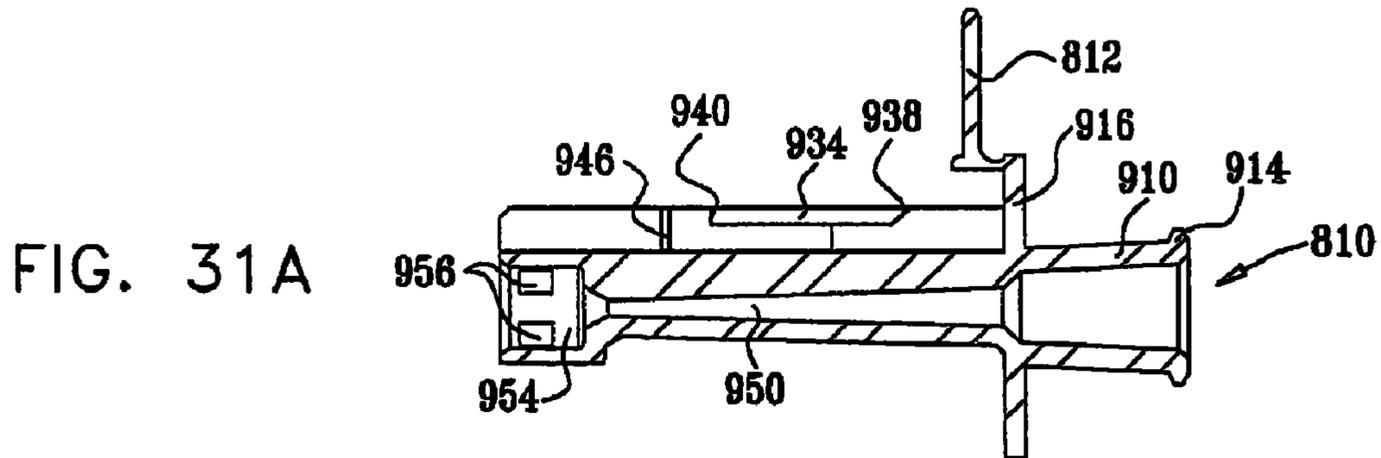
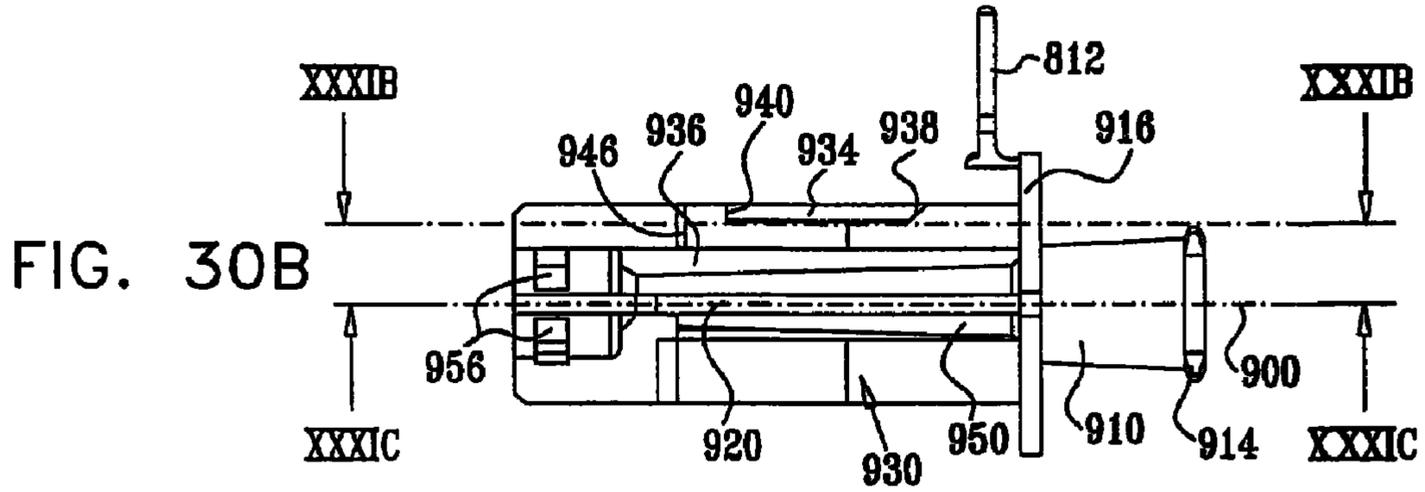
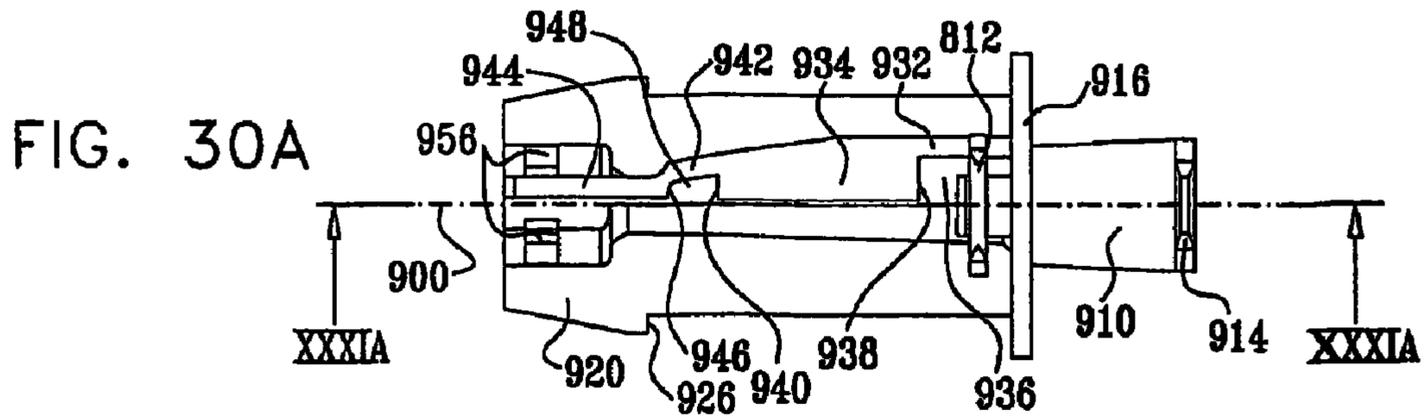
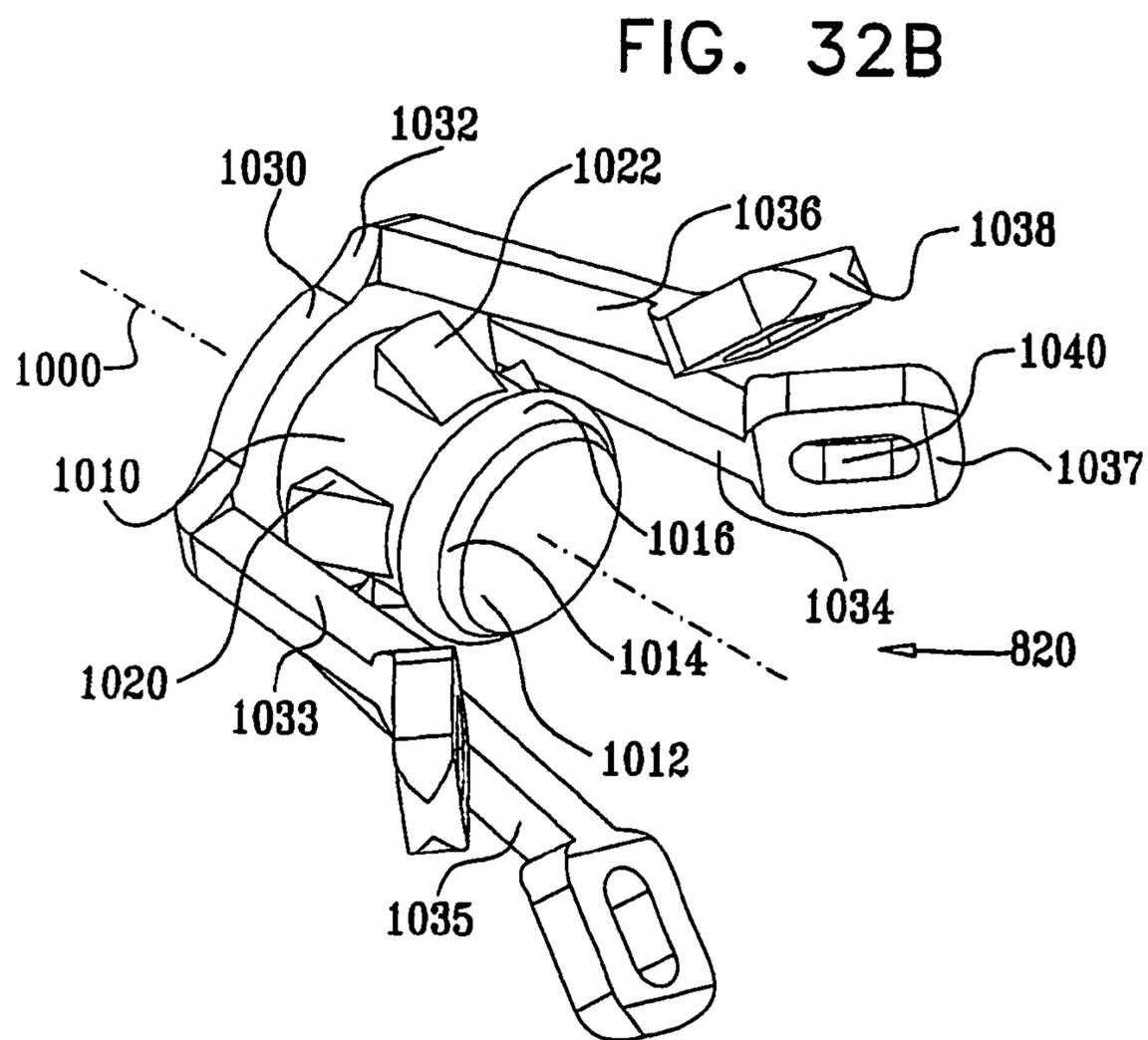
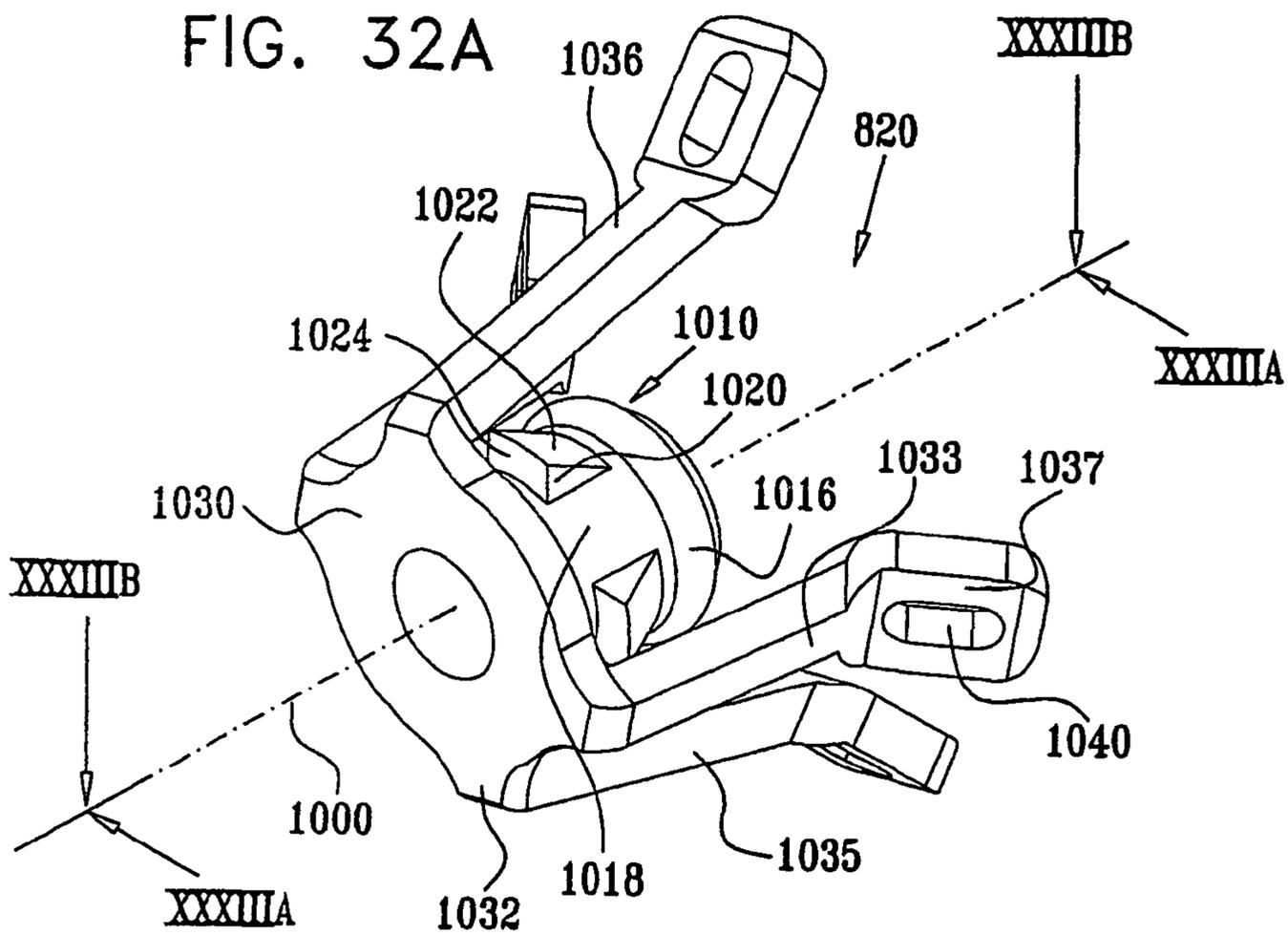


FIG. 29B







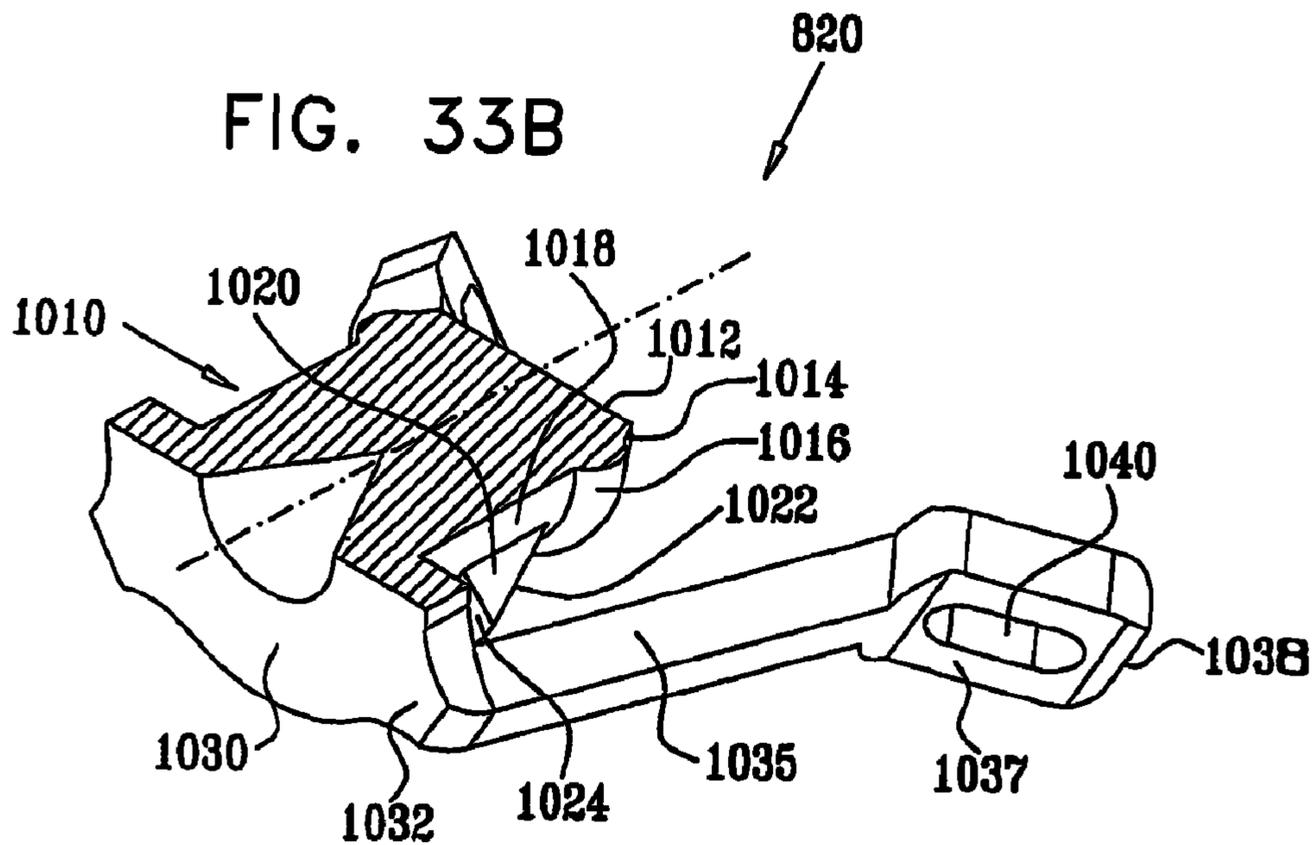
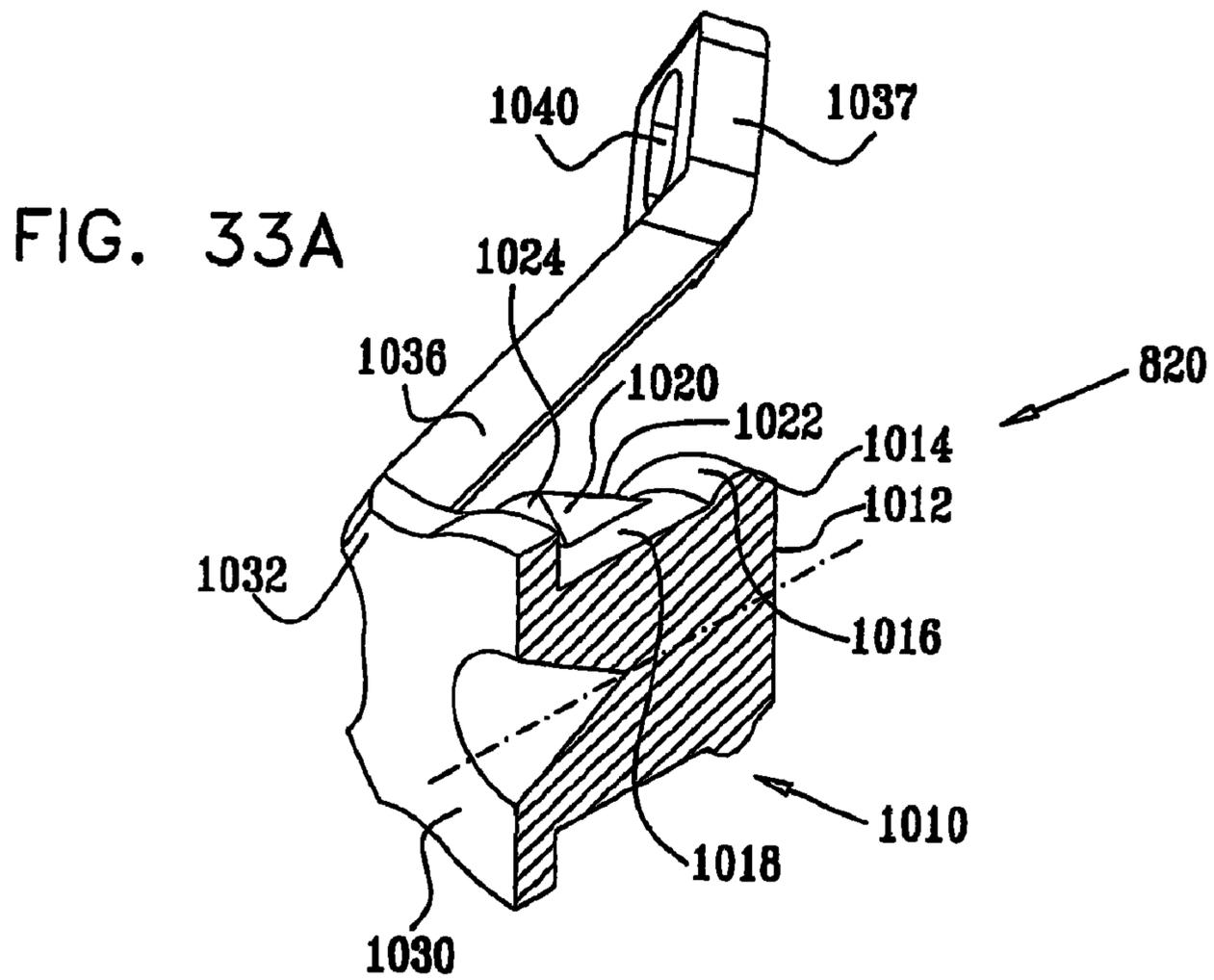


FIG. 34A

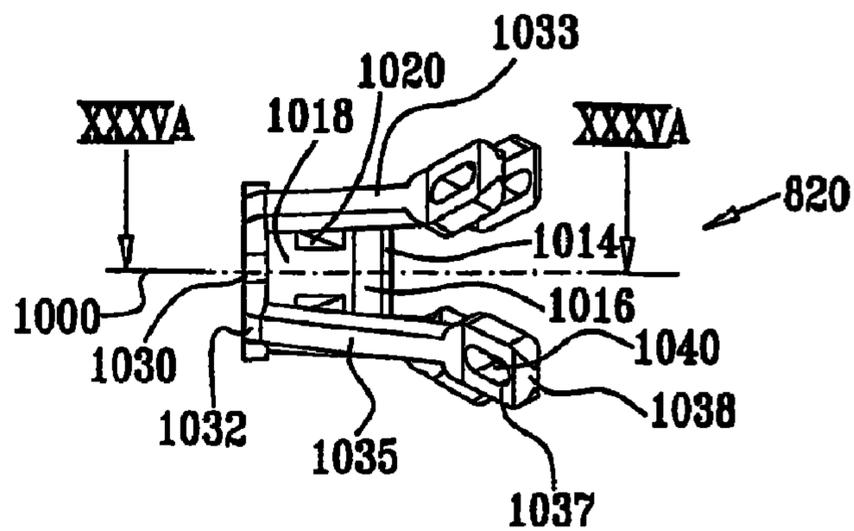


FIG. 34B

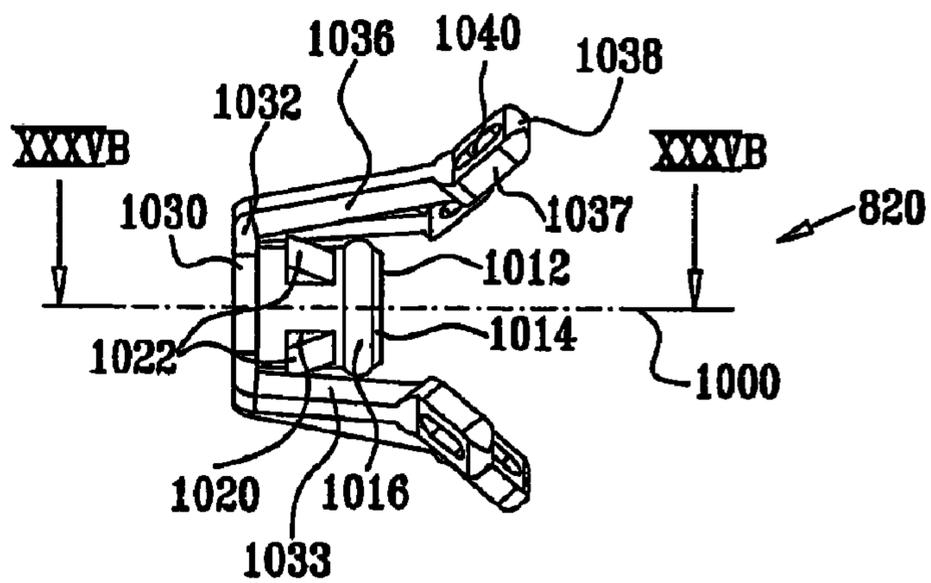


FIG. 35A

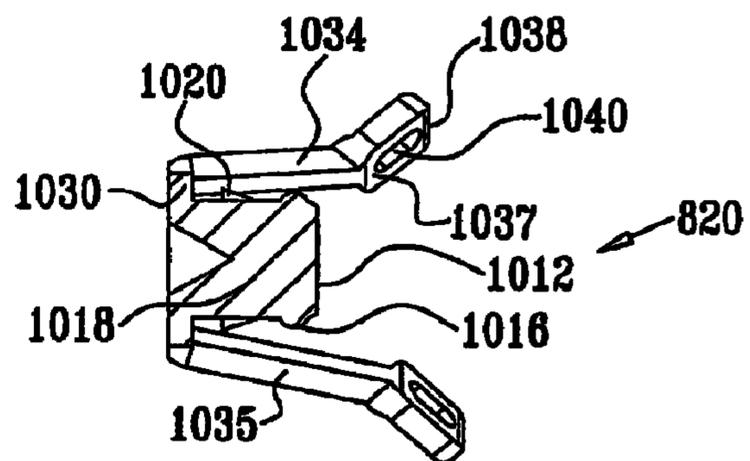
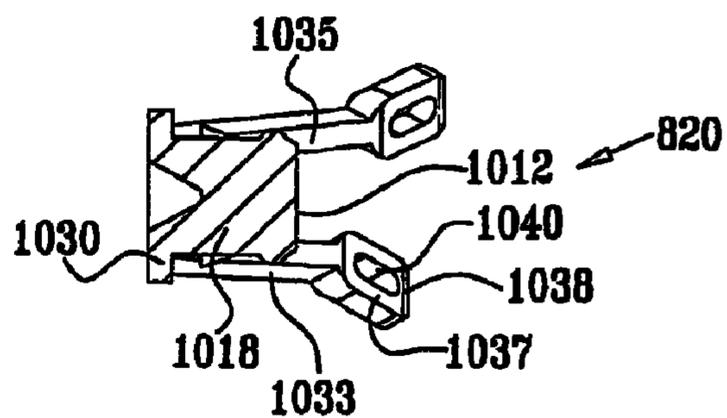
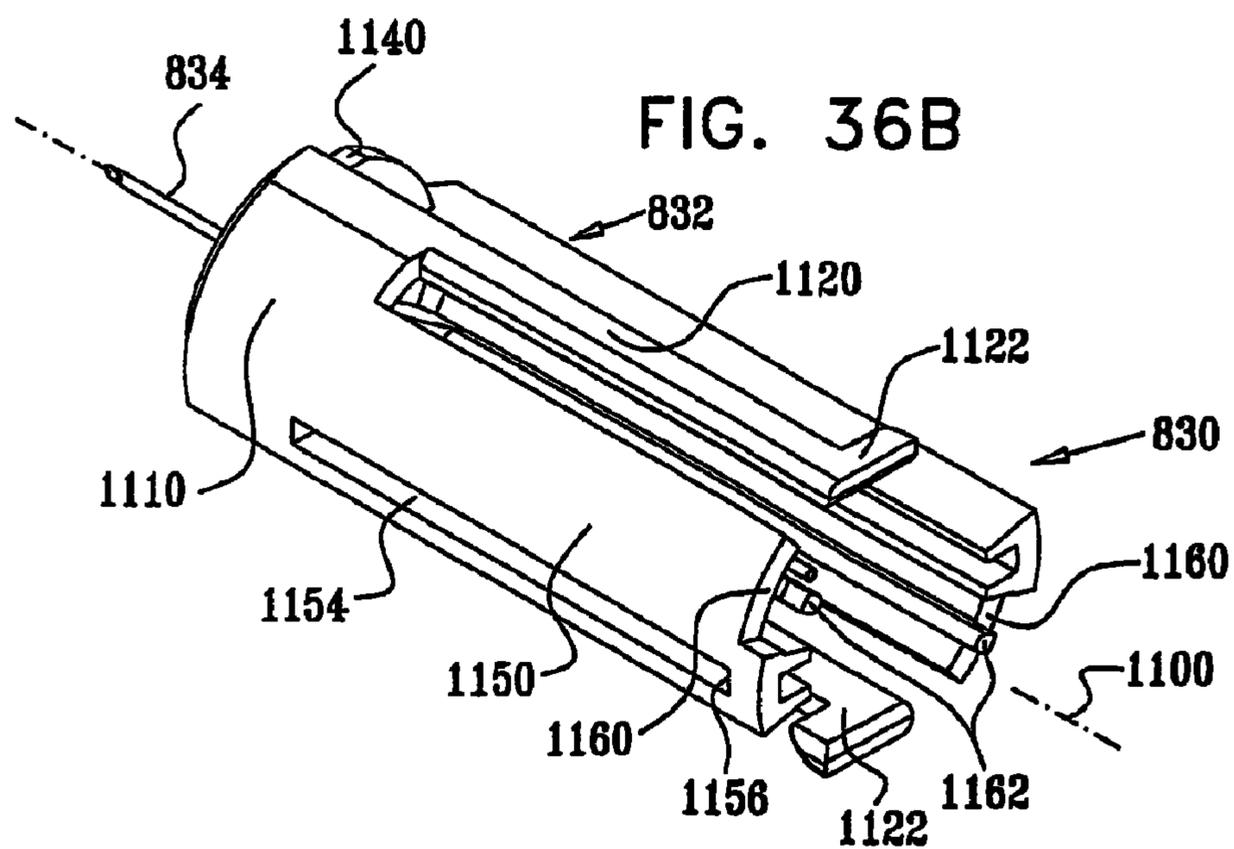
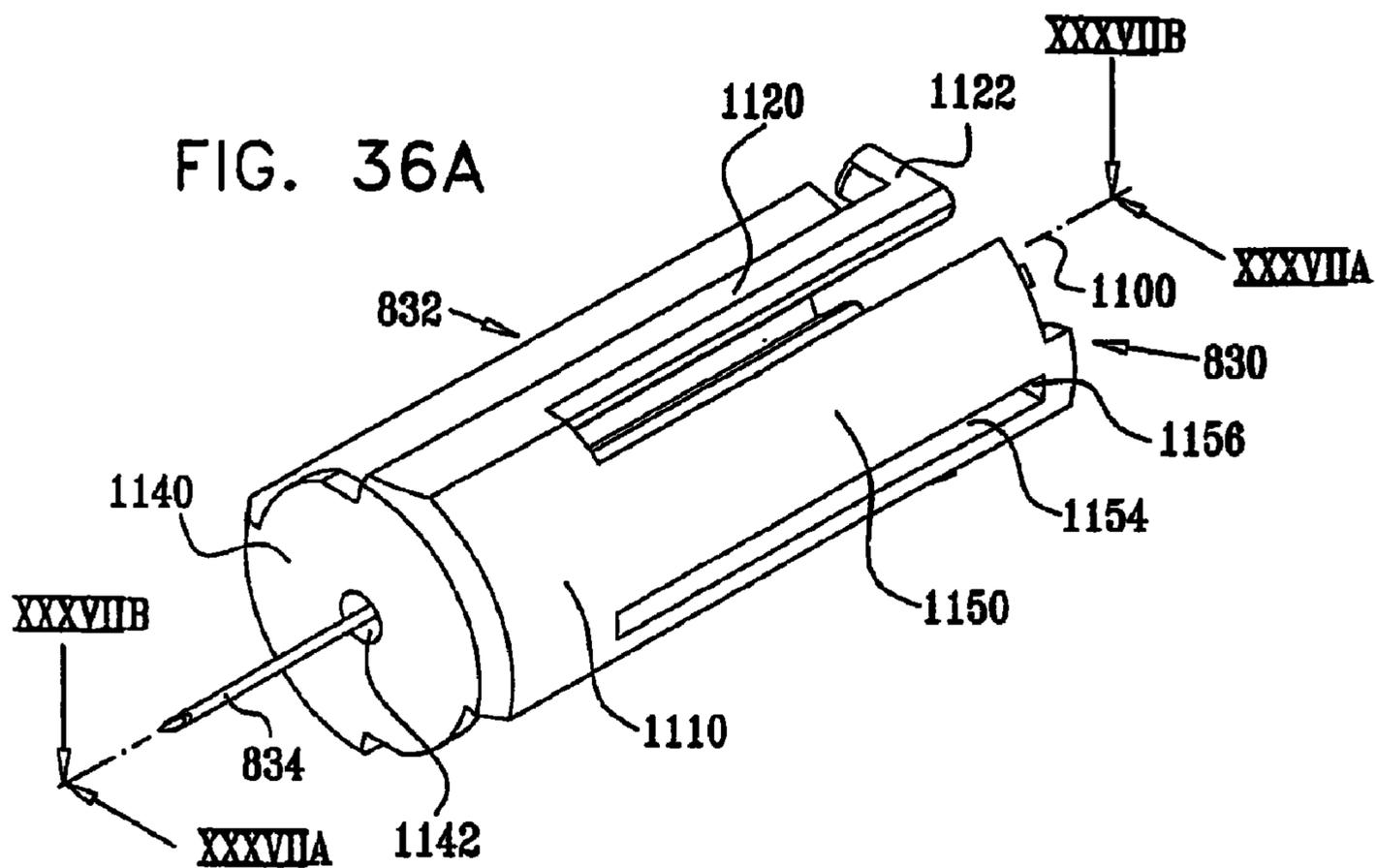


FIG. 35B





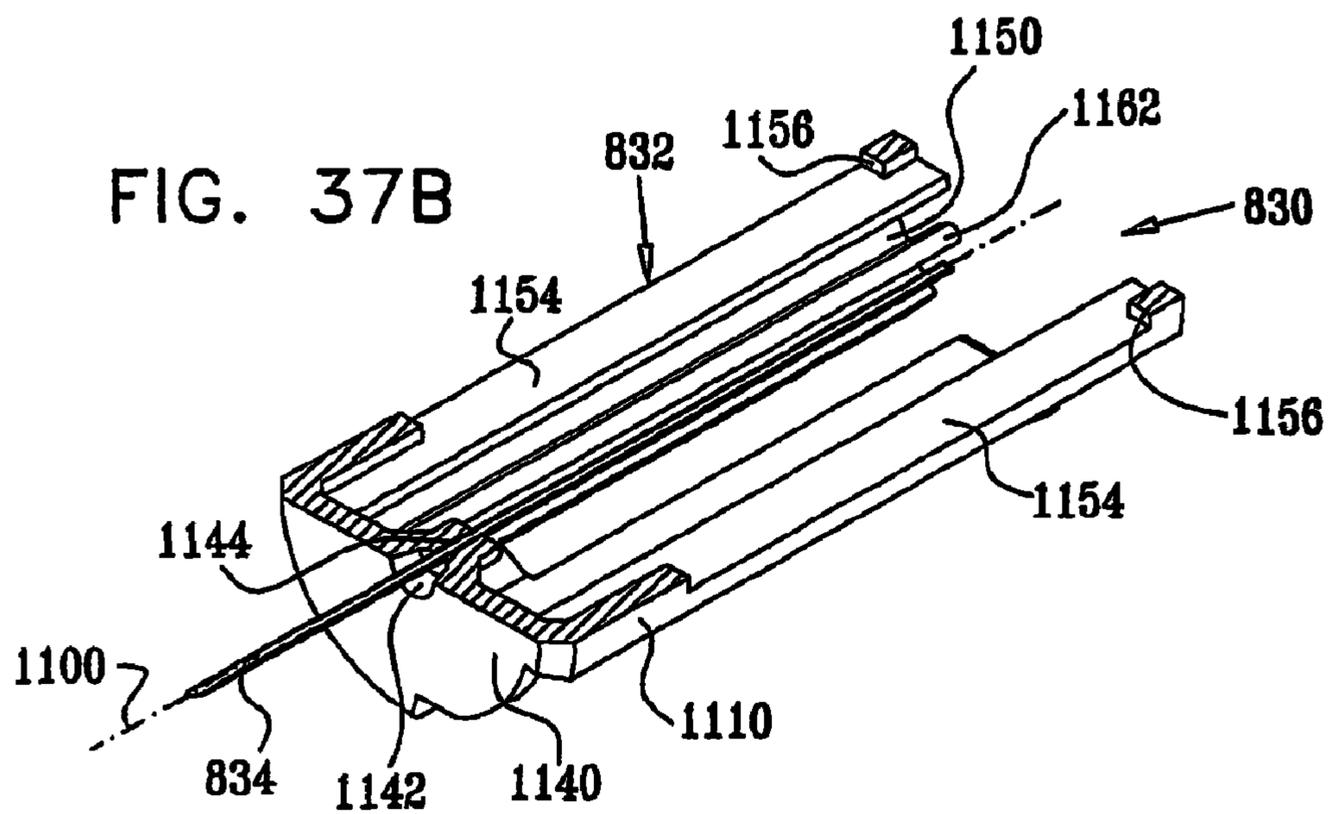
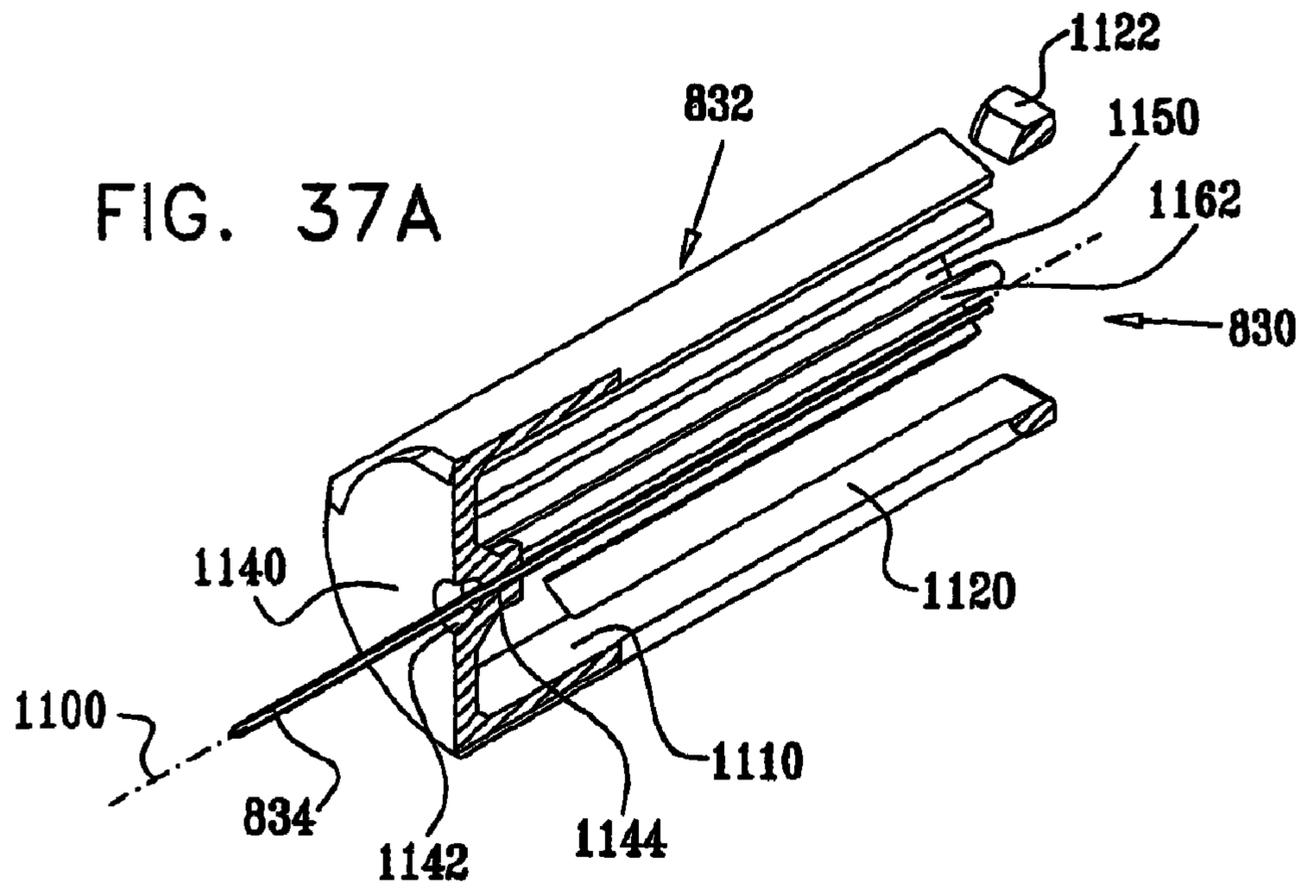


FIG. 38A

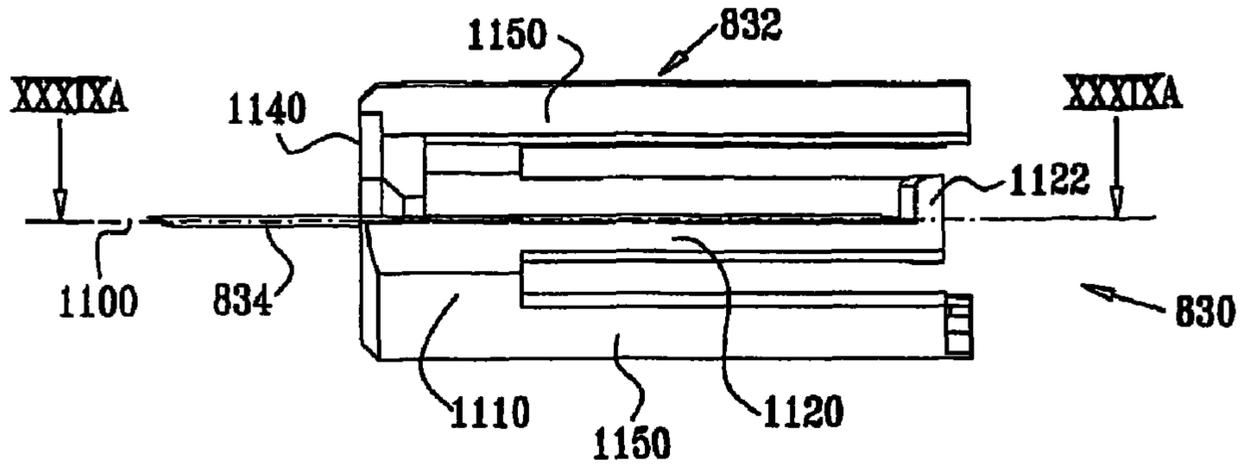


FIG. 38B

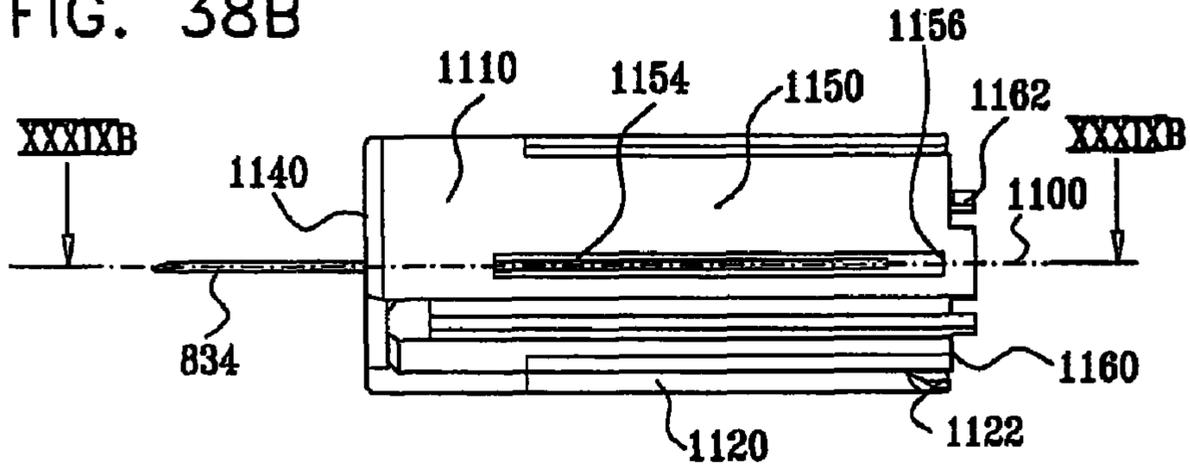


FIG. 39A

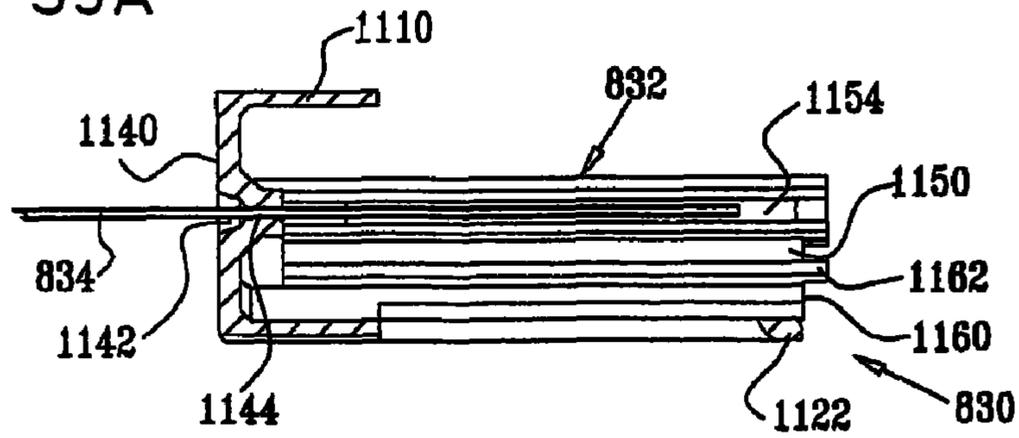
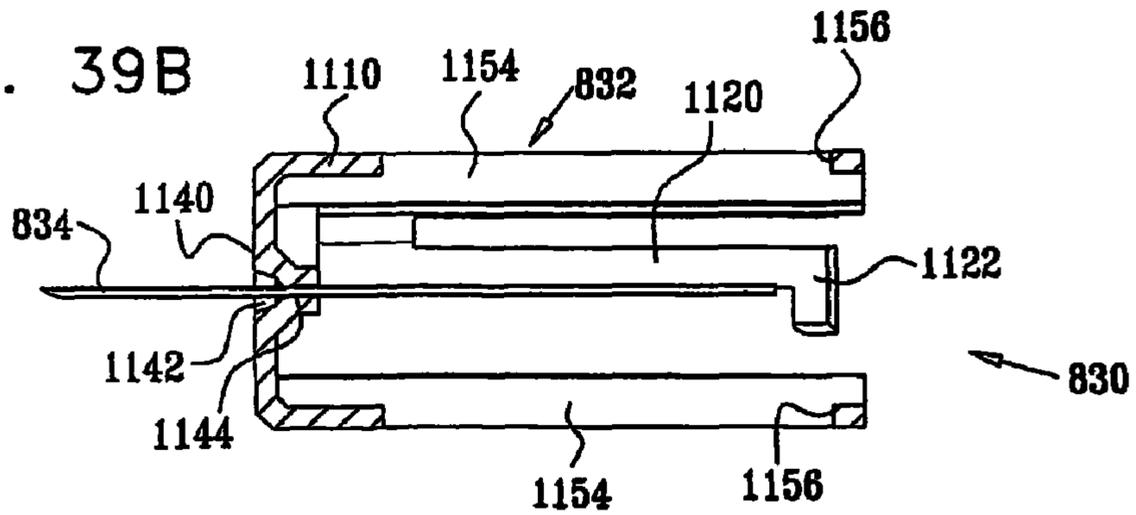
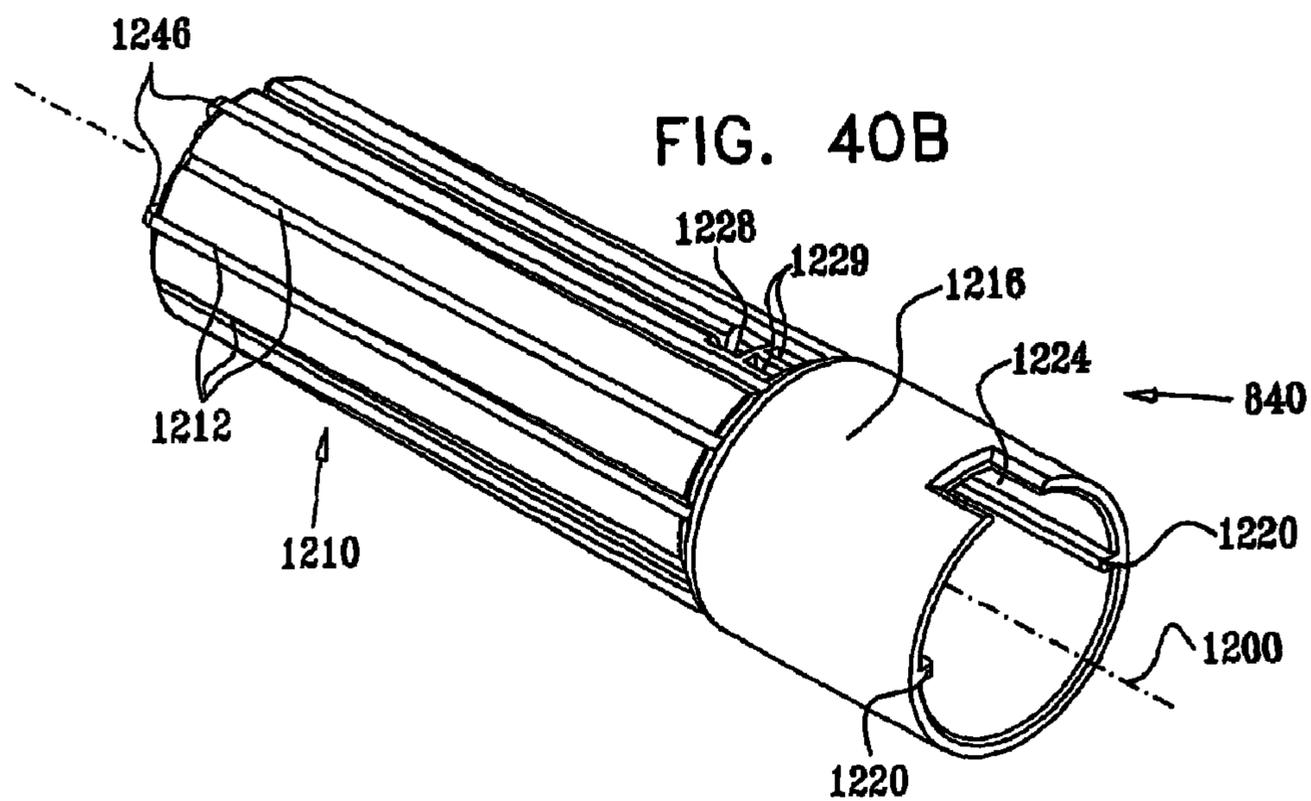
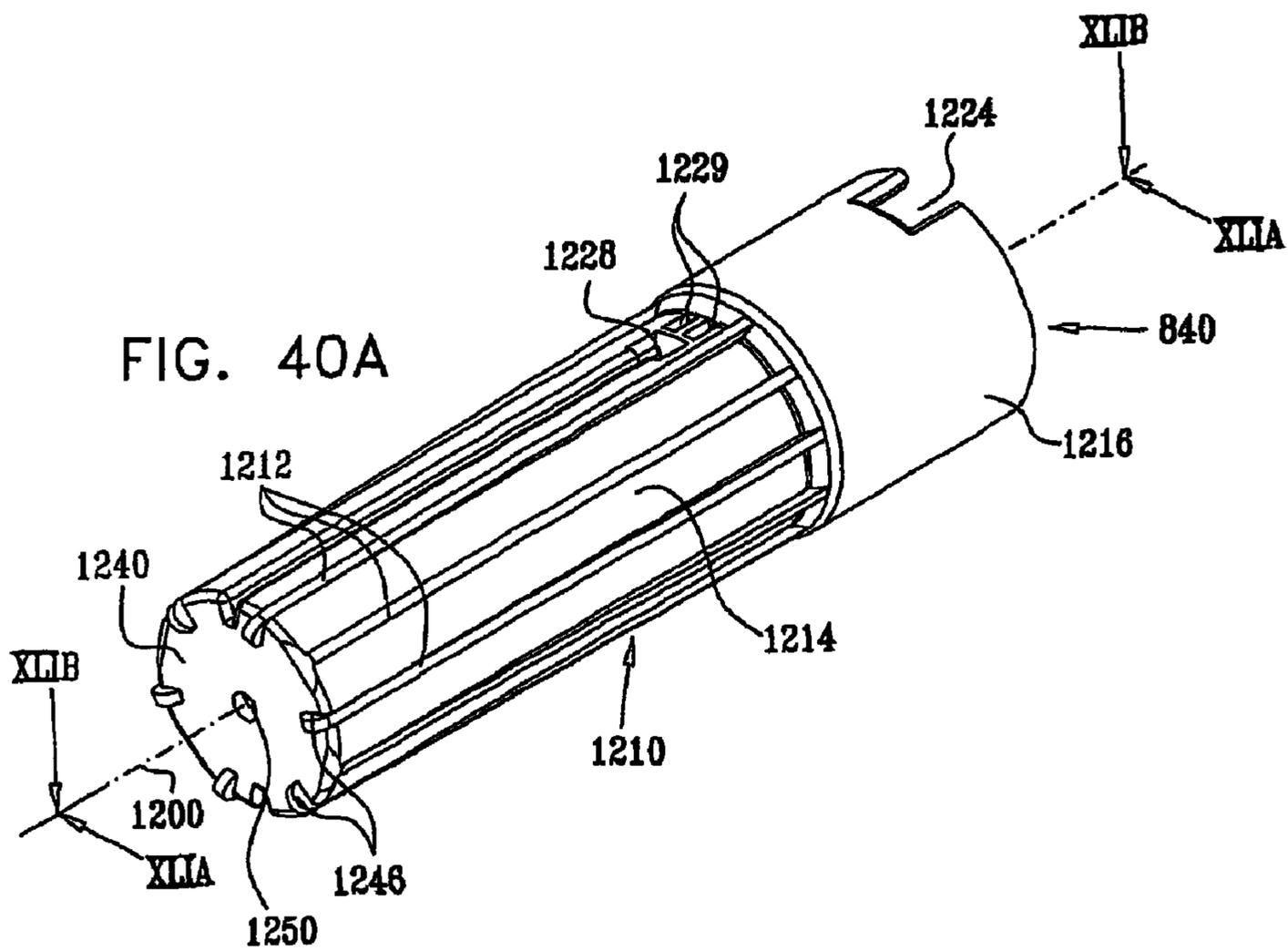


FIG. 39B





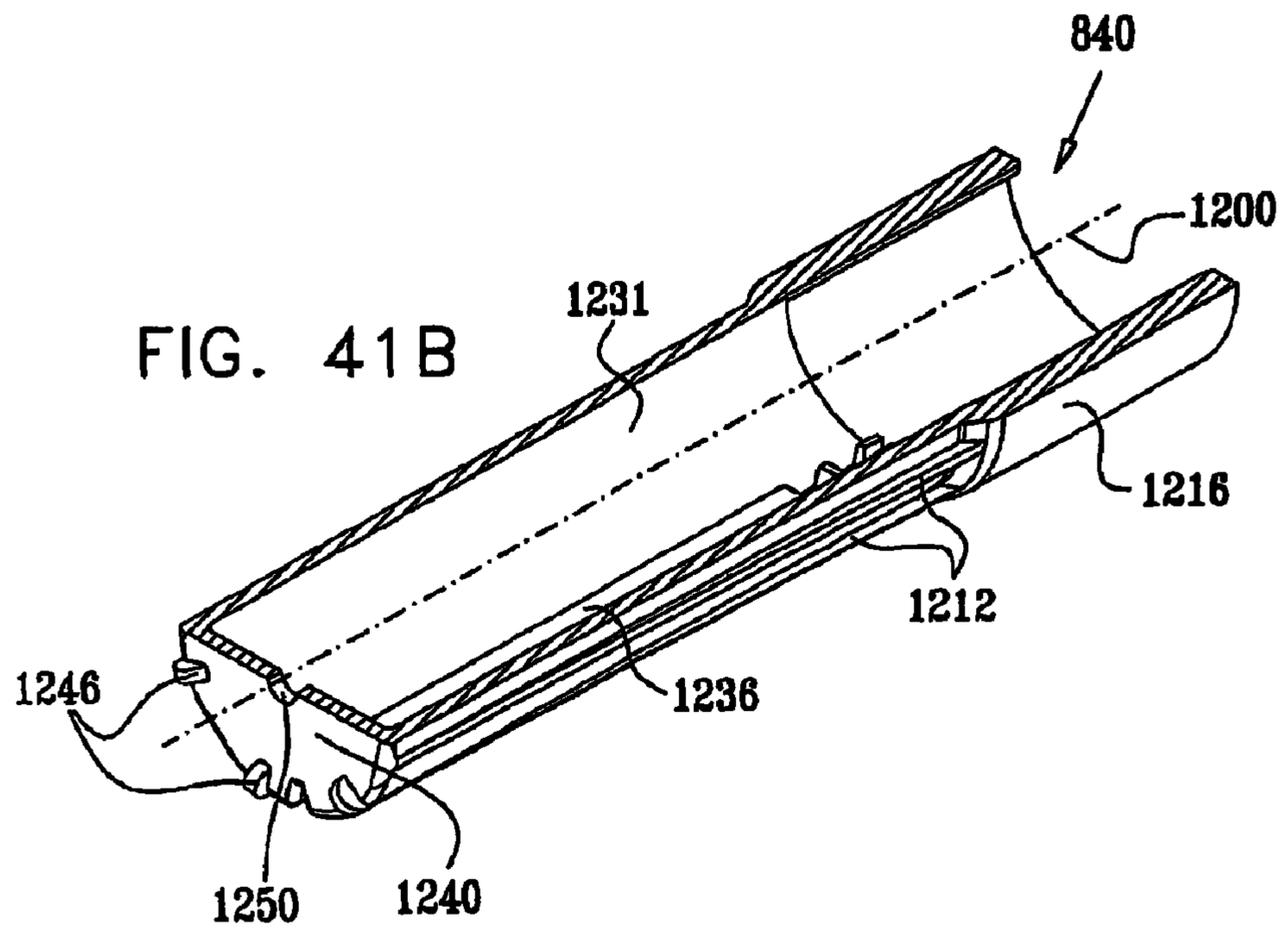
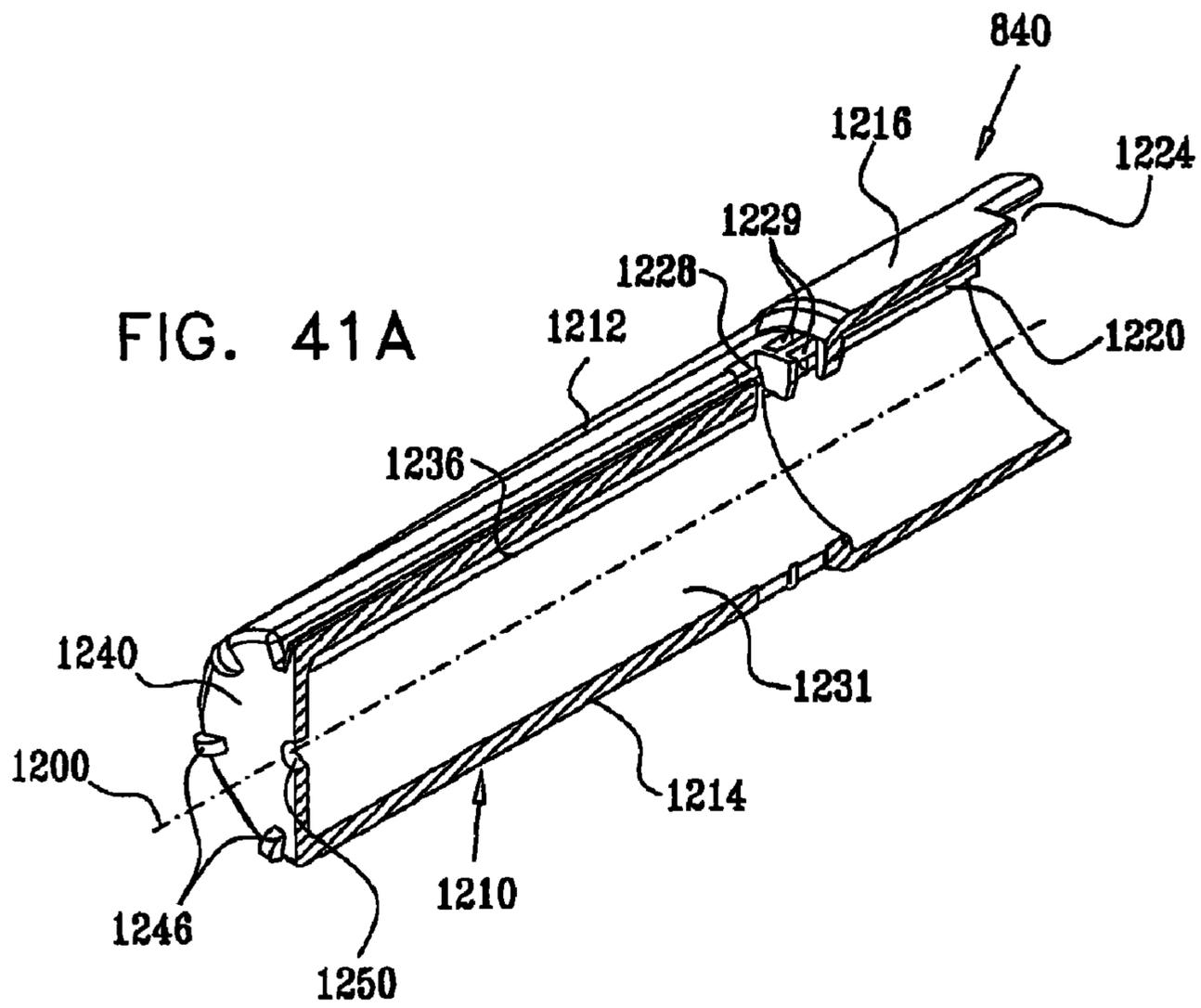


FIG. 42A

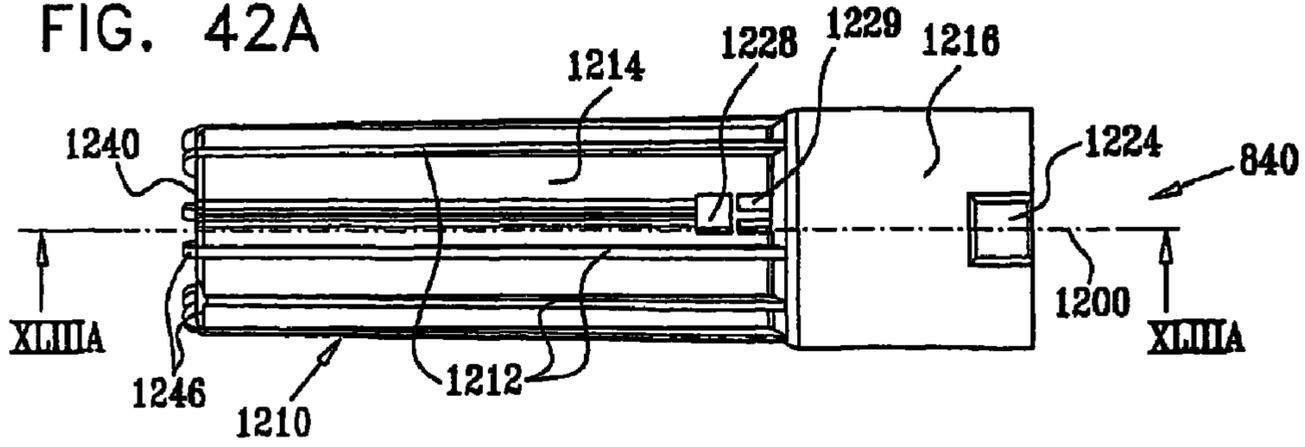


FIG. 42B

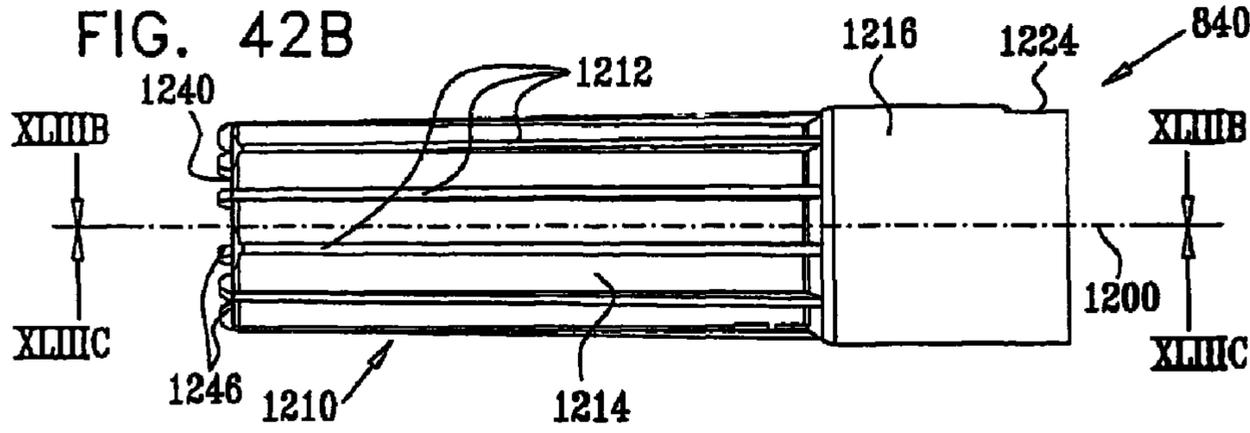


FIG. 43A

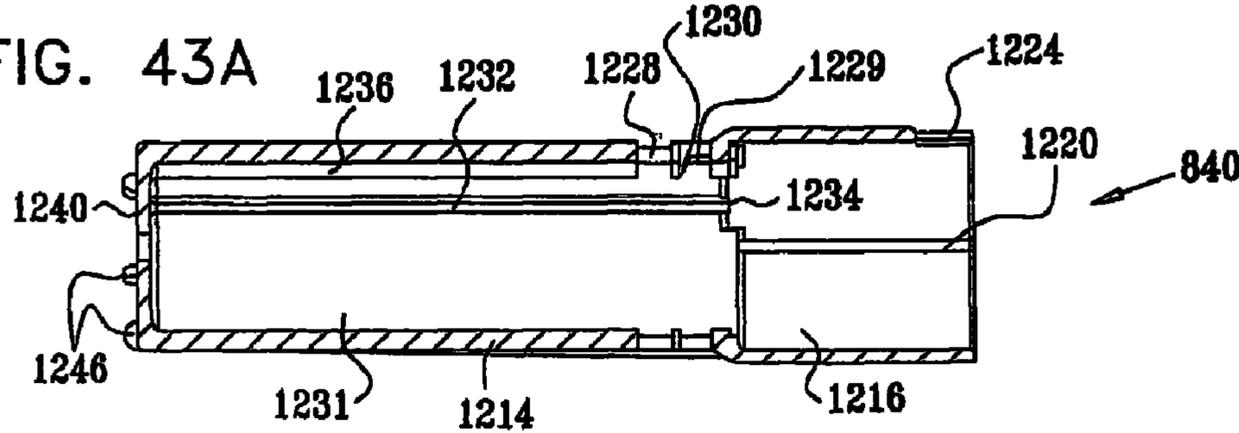


FIG. 43B

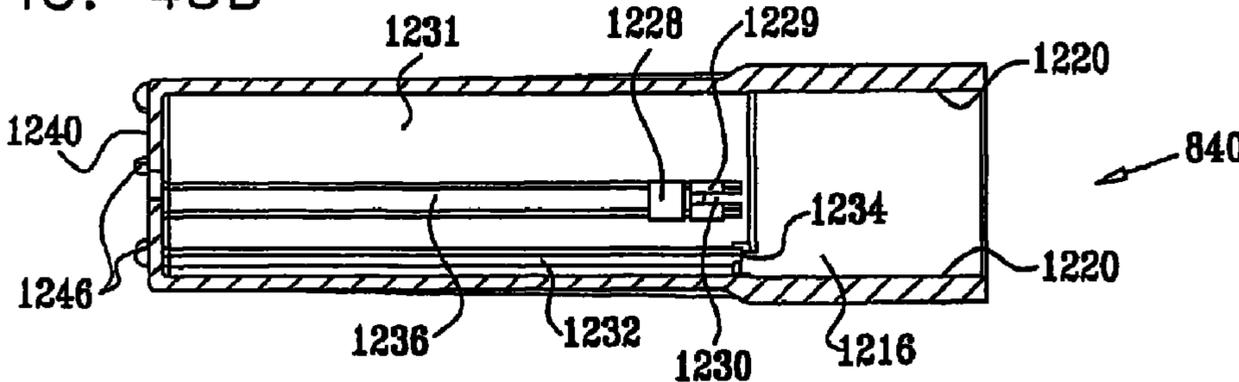
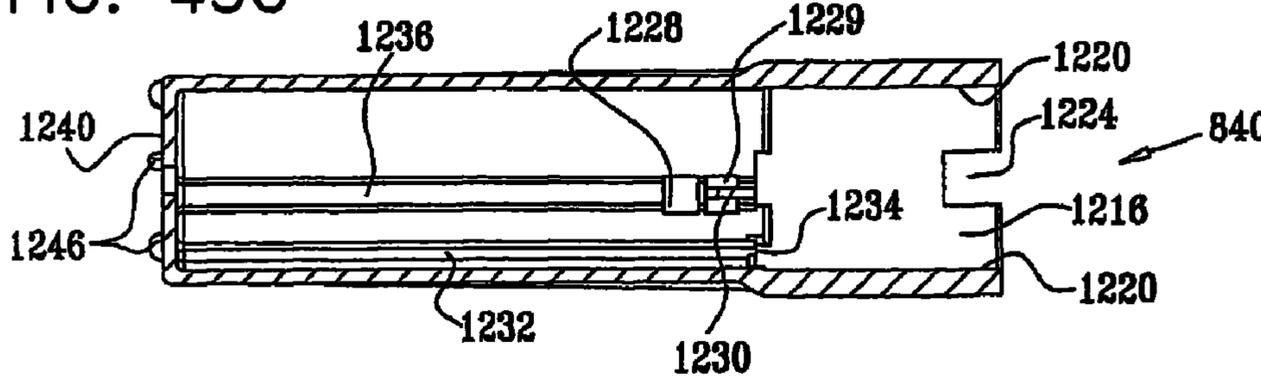


FIG. 43C



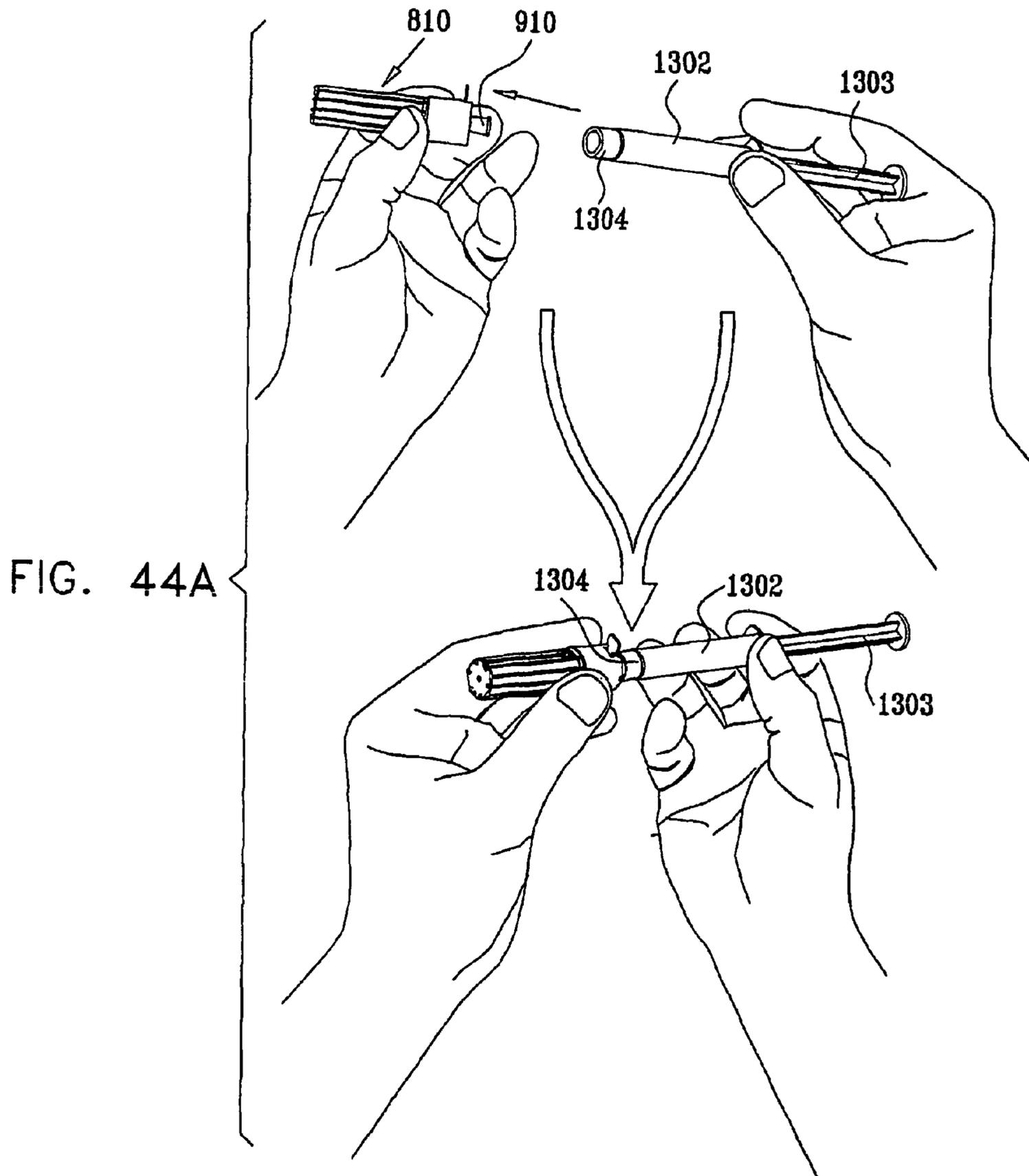
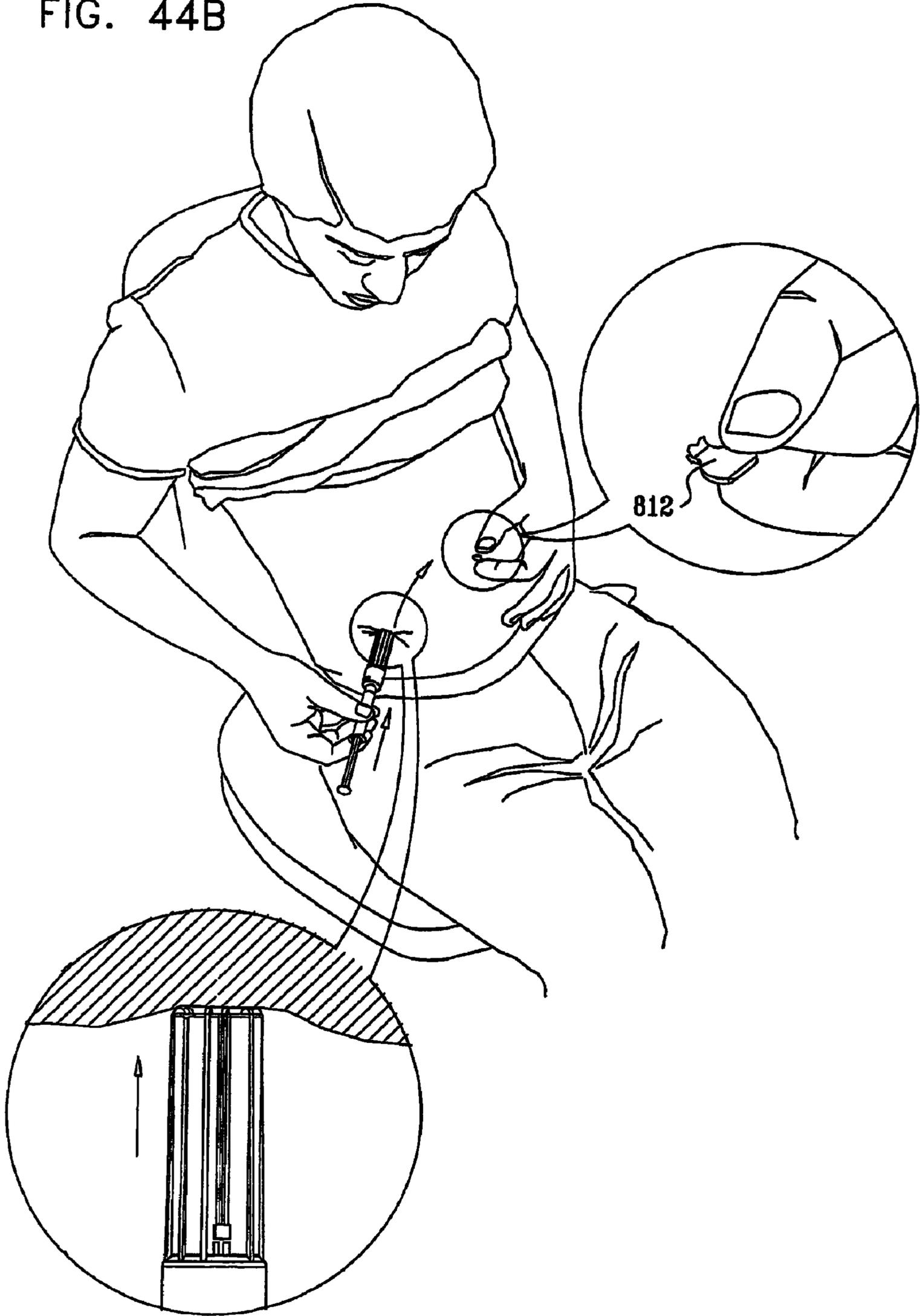


FIG. 44B



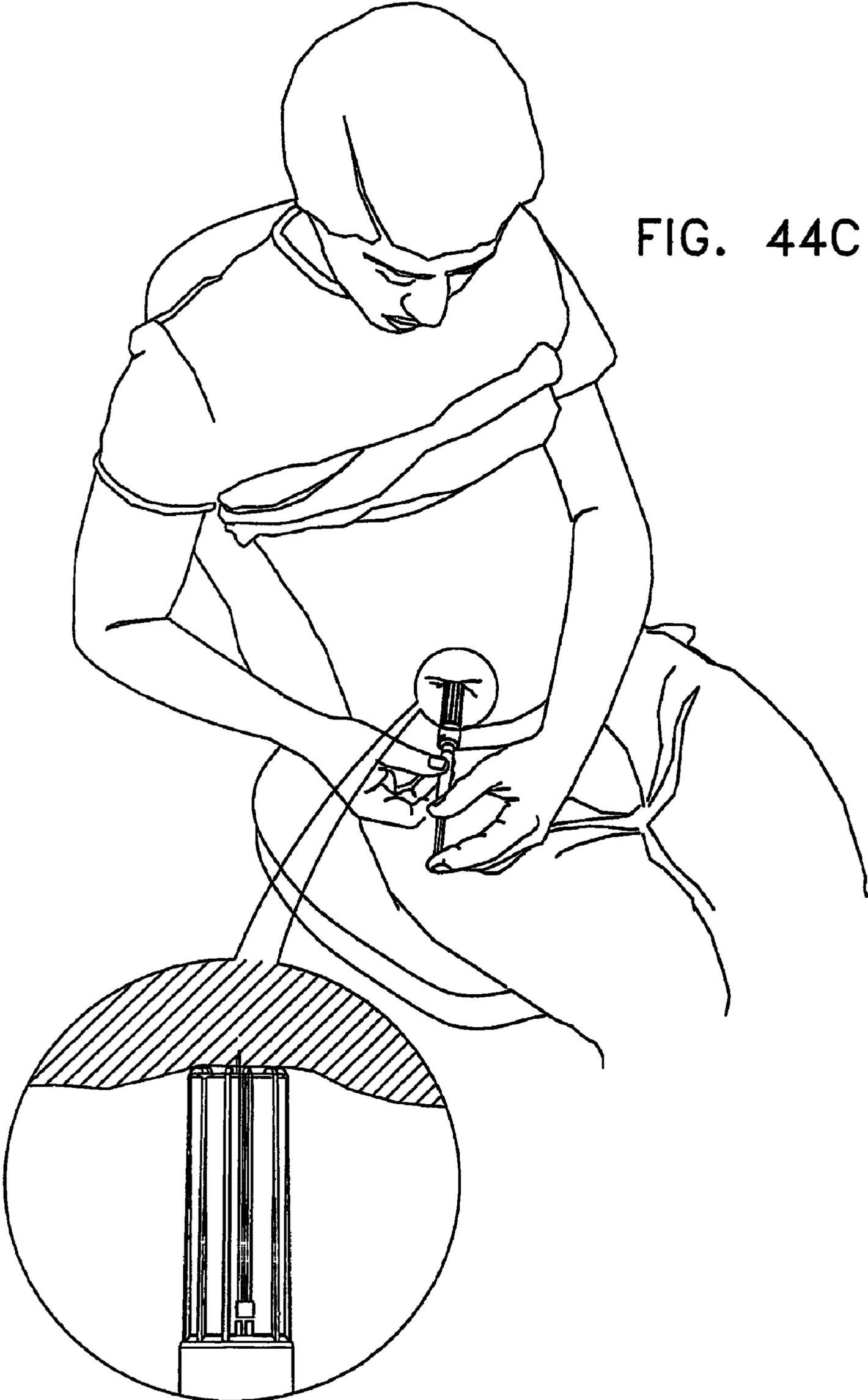
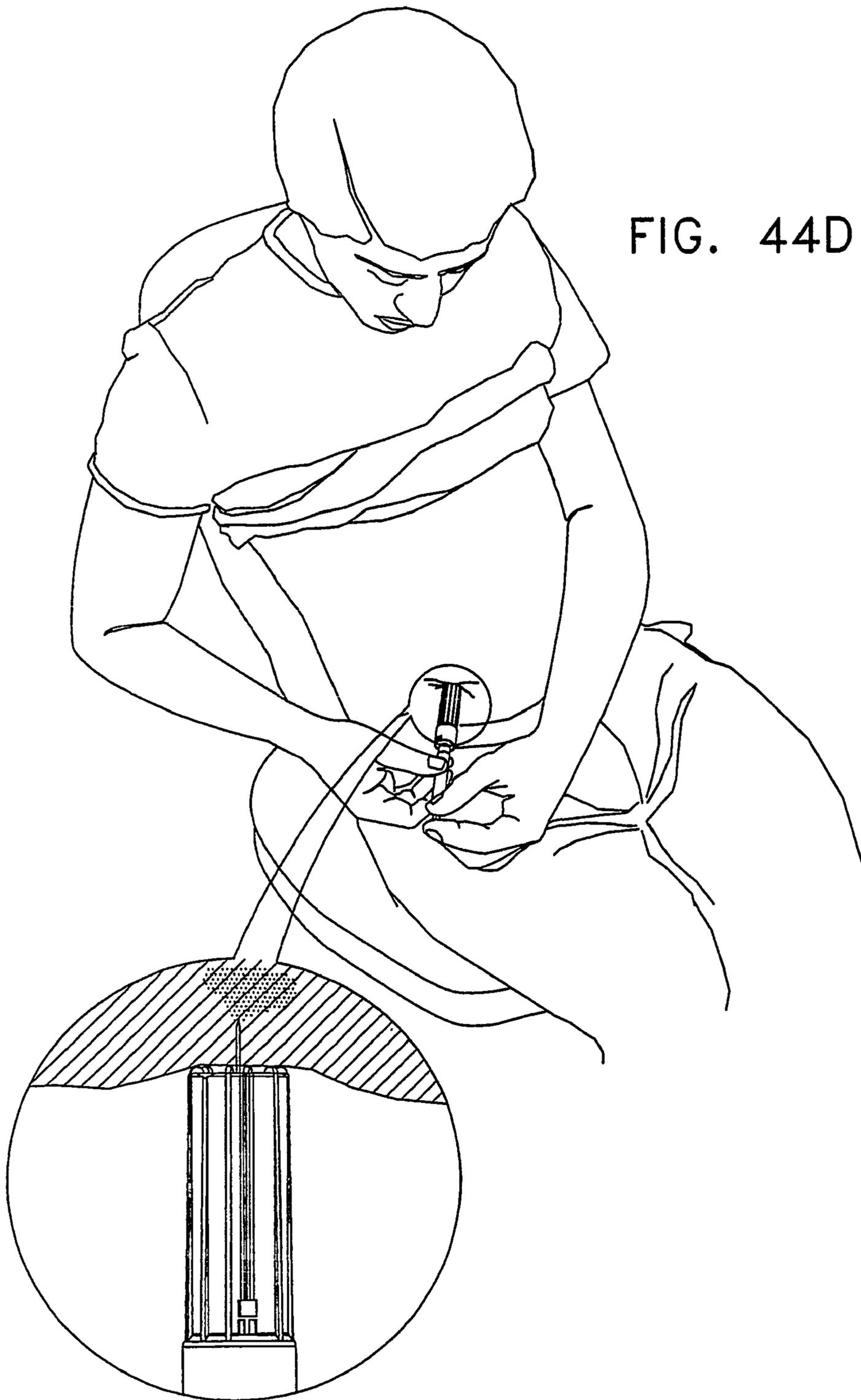


FIG. 44C



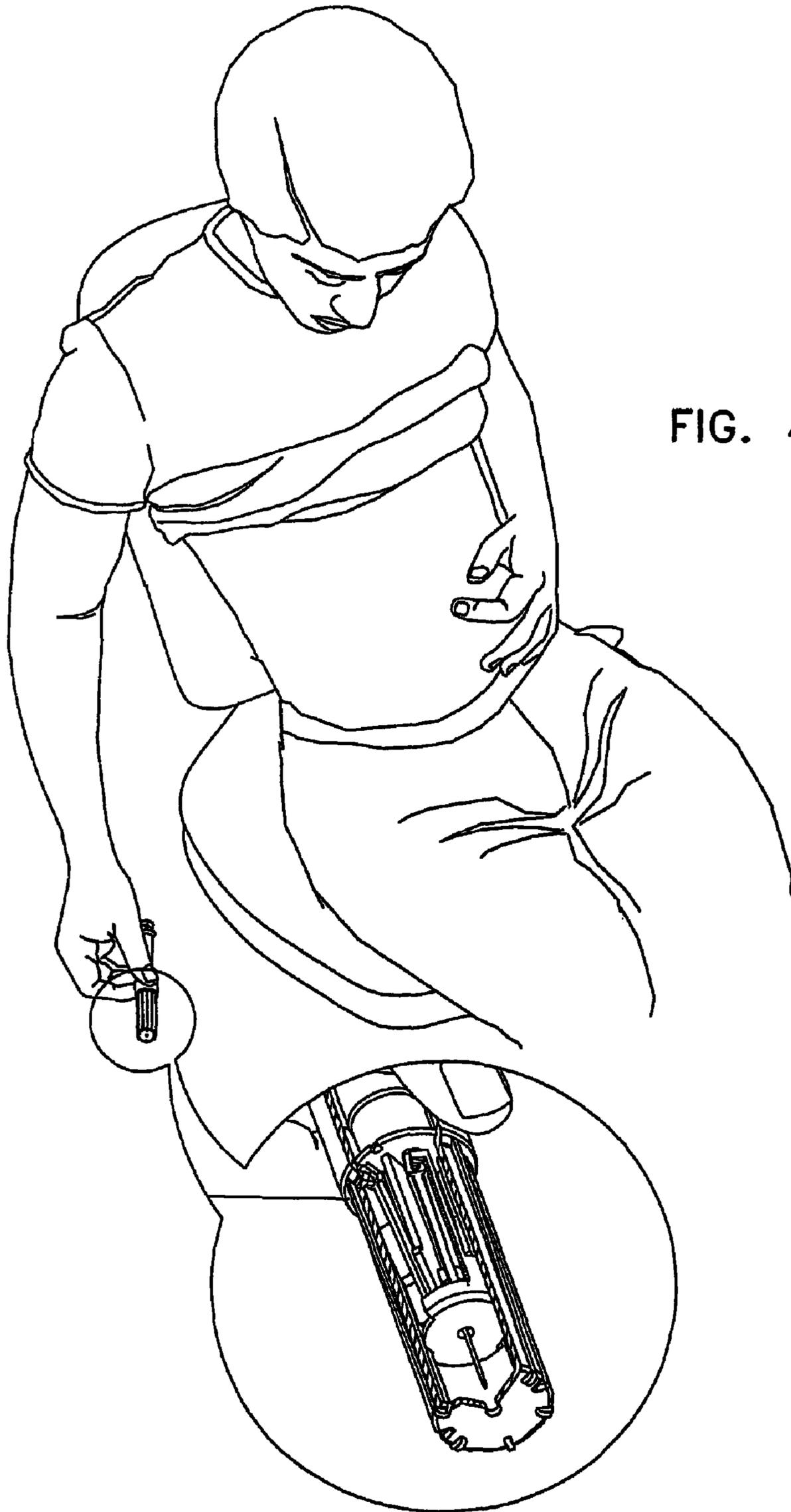


FIG. 44E



FIG. 44F

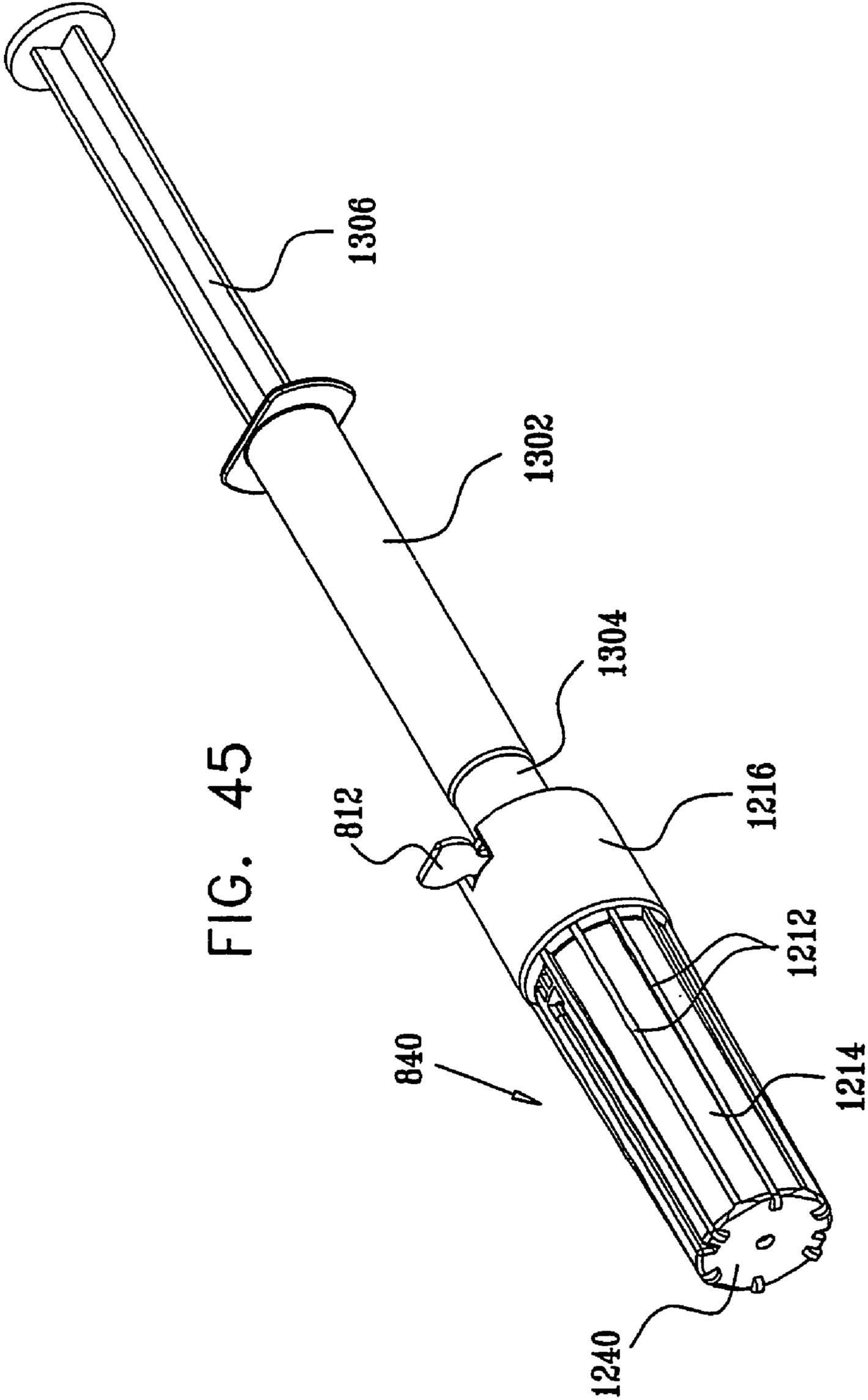
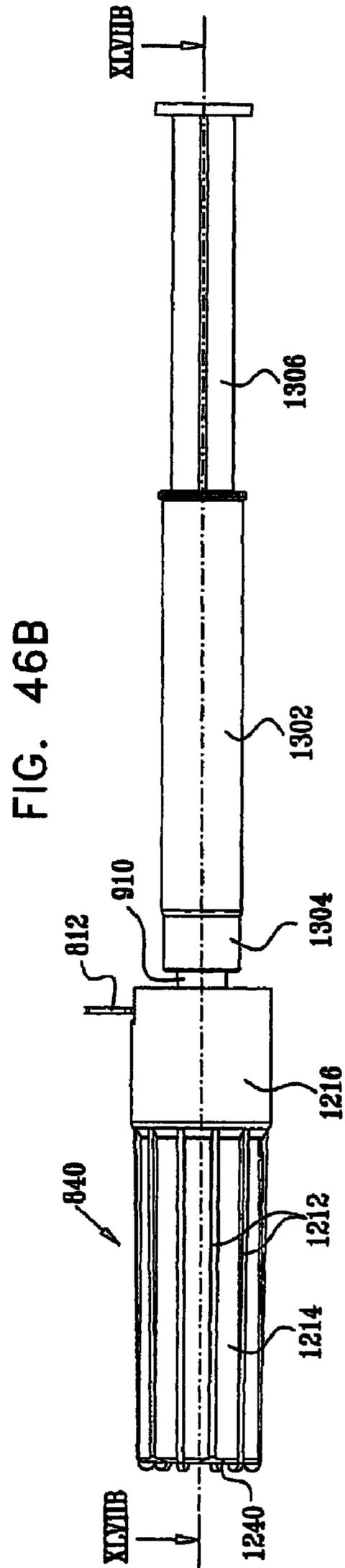
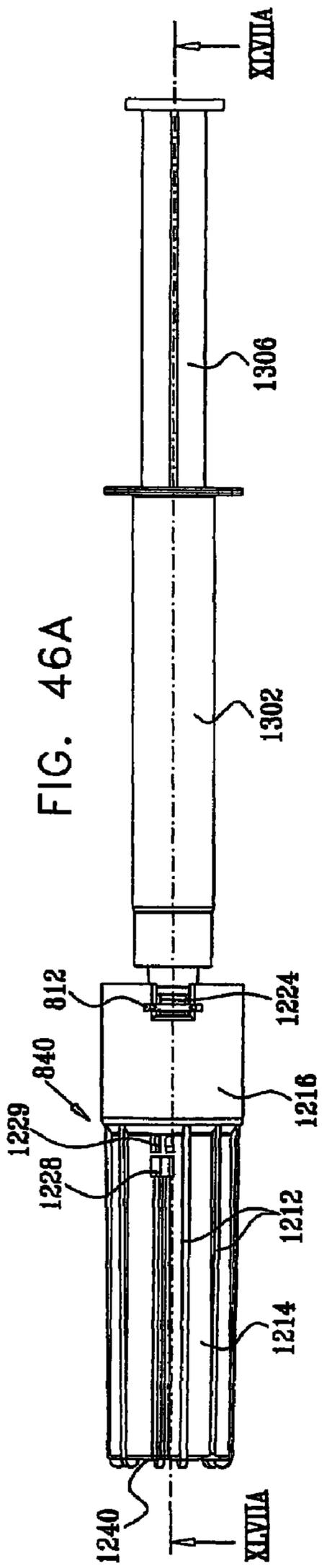
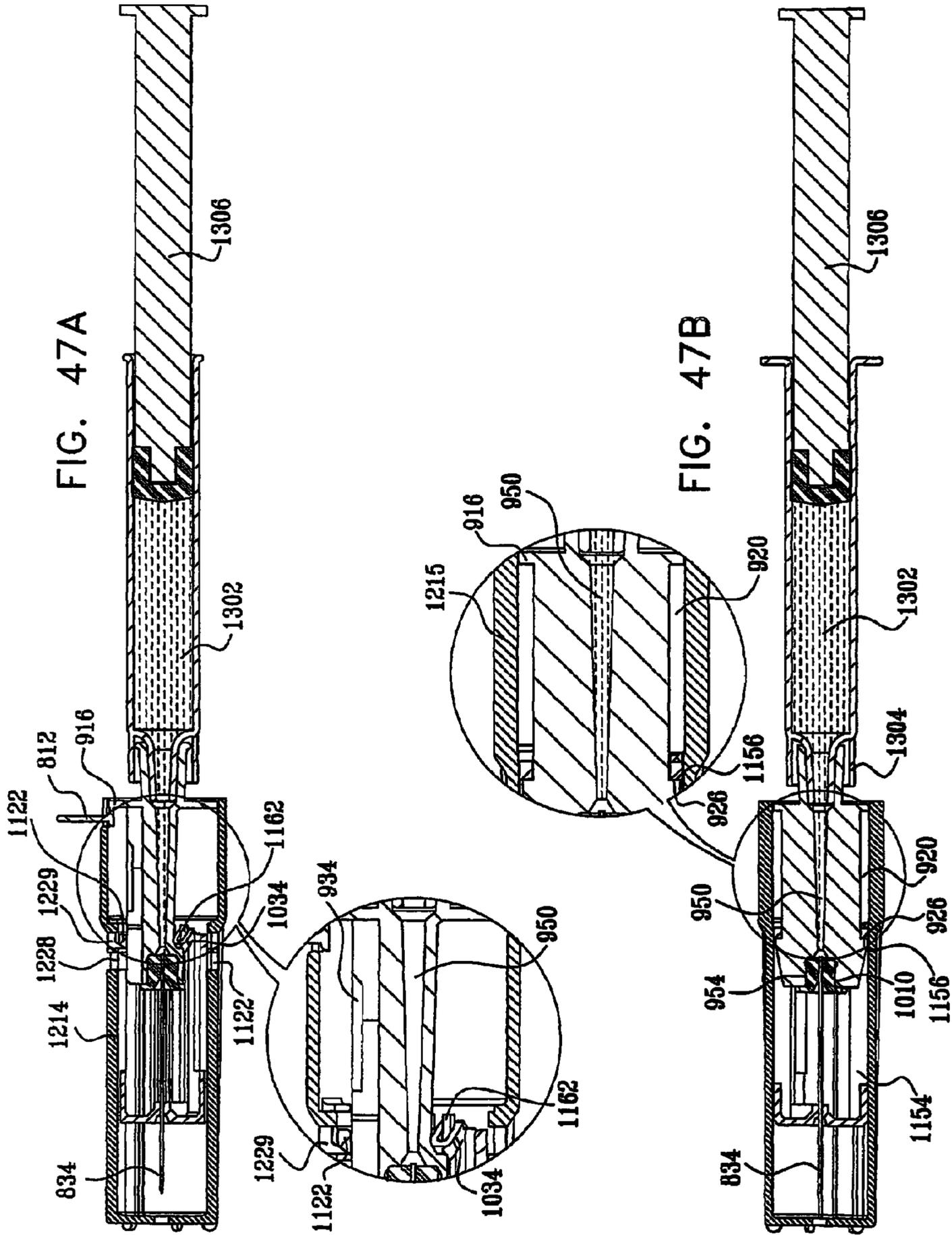
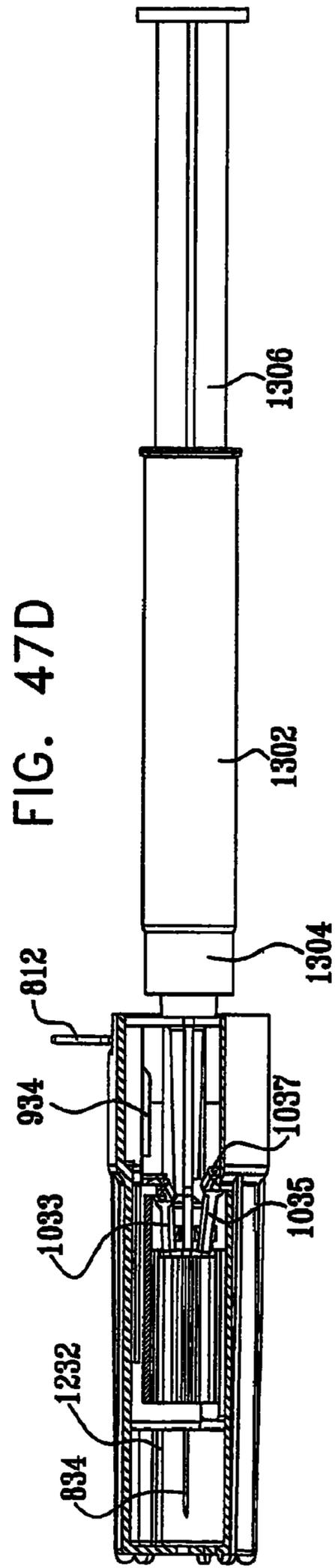
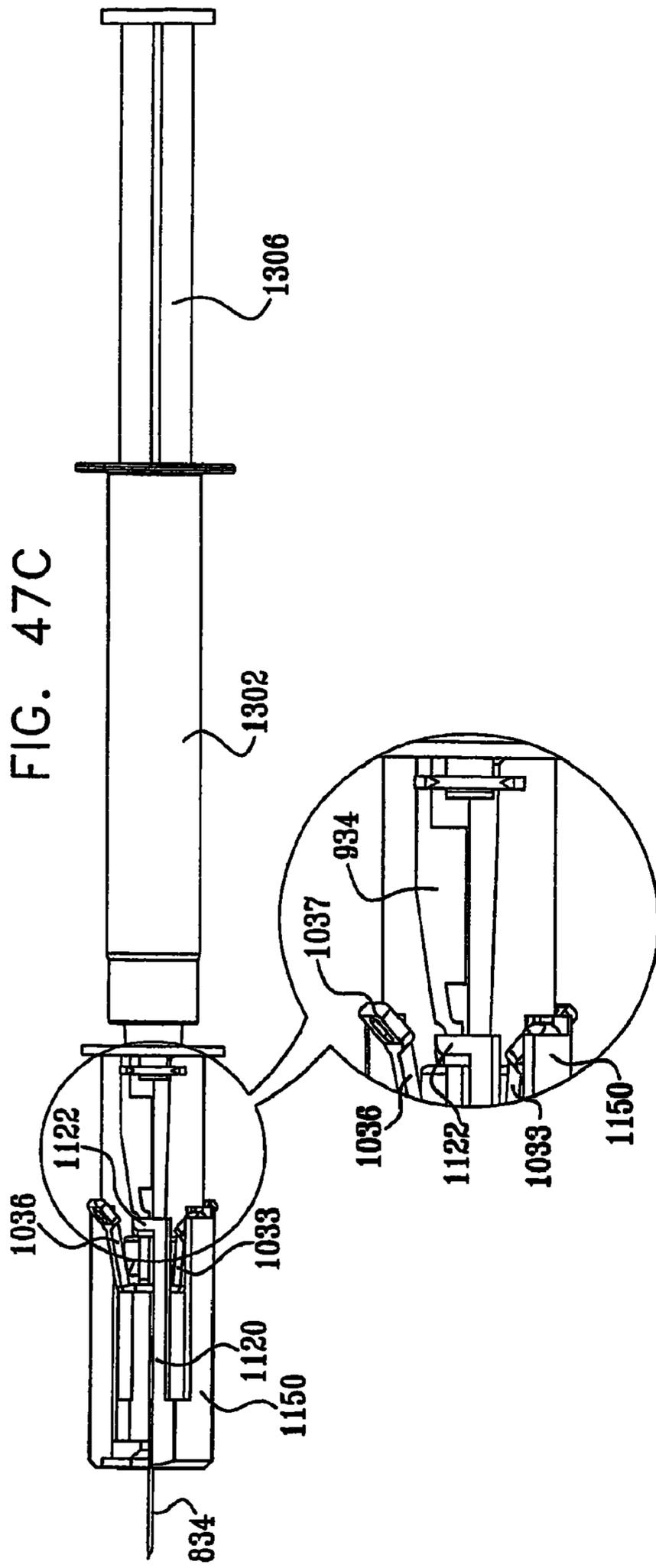


FIG. 45







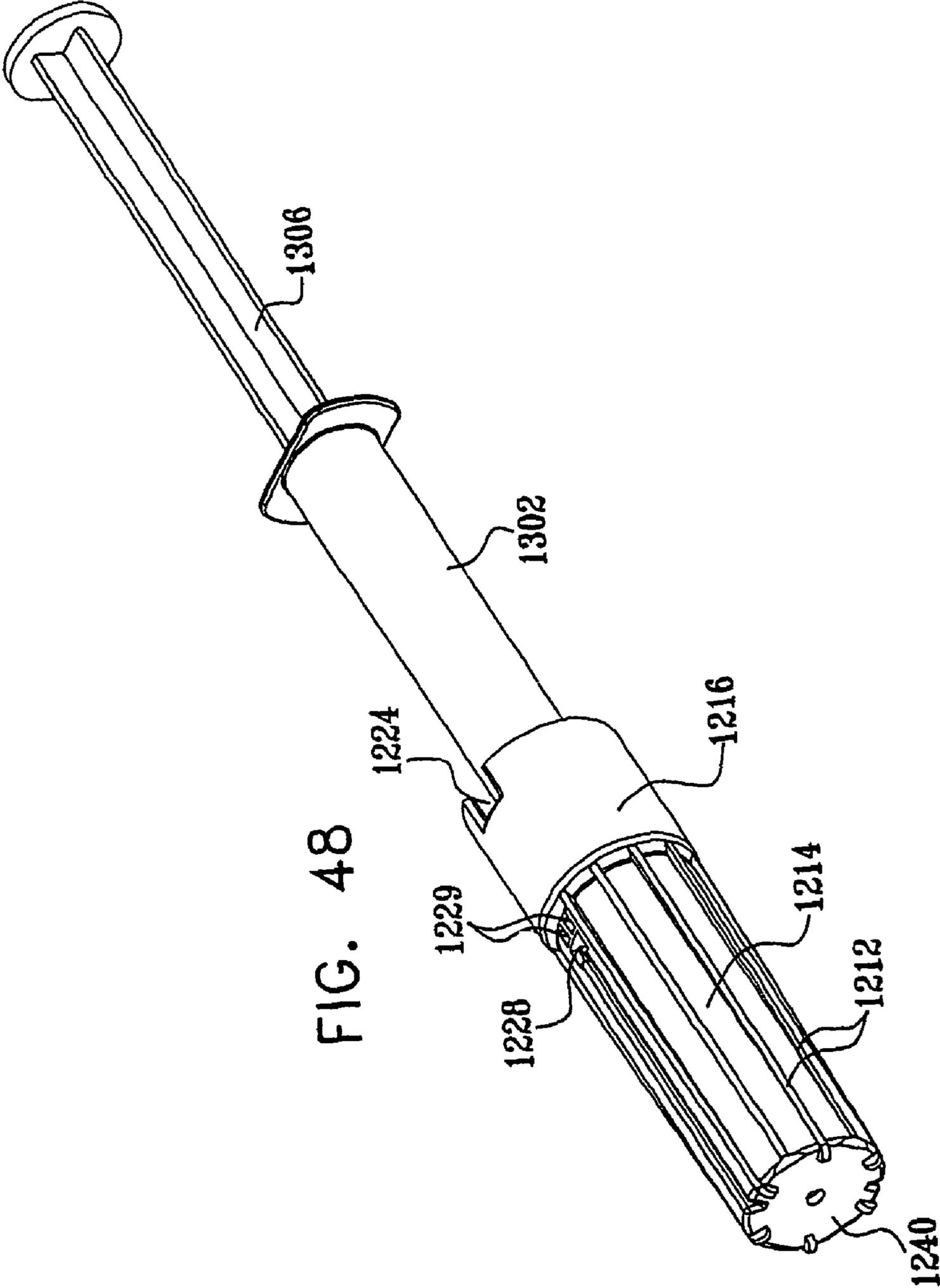
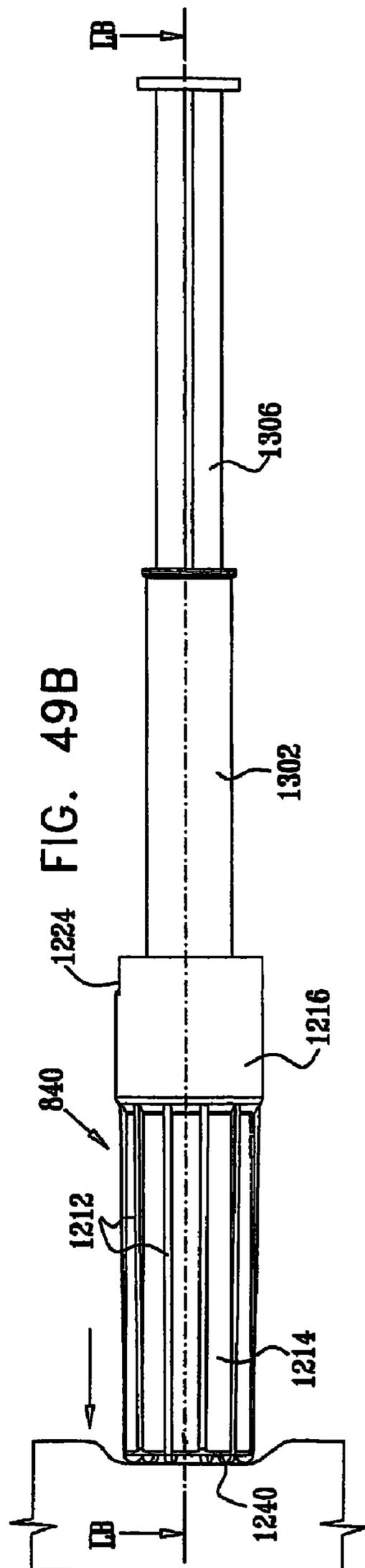
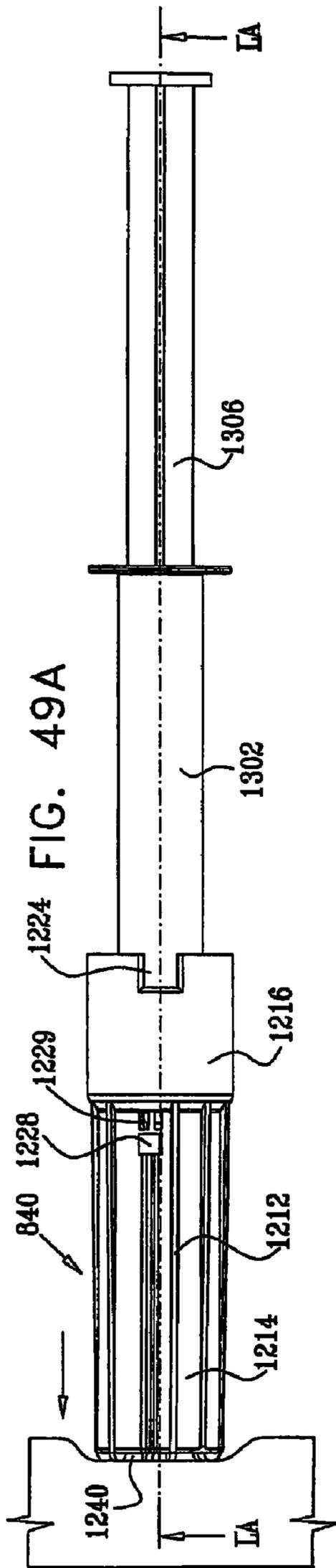
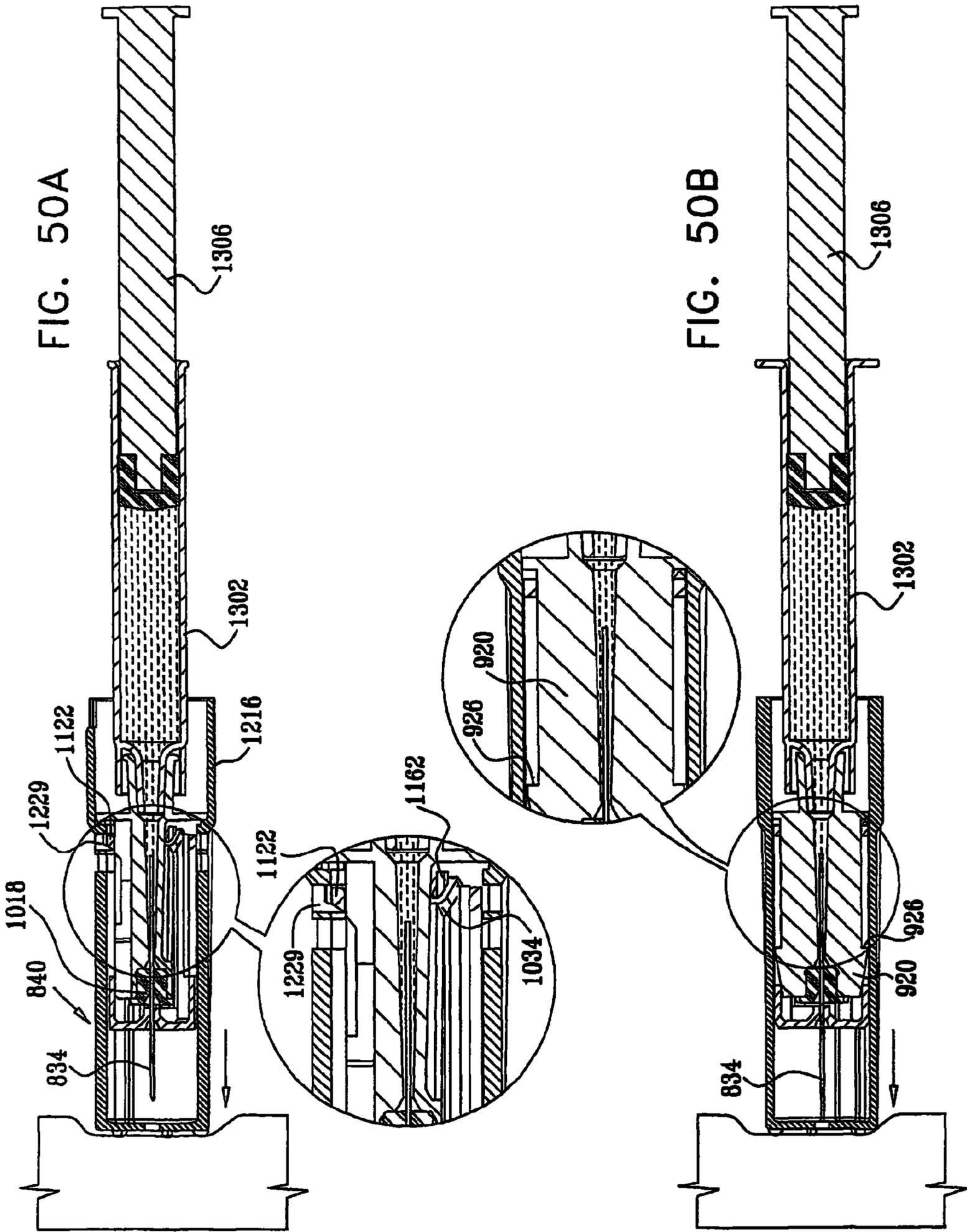
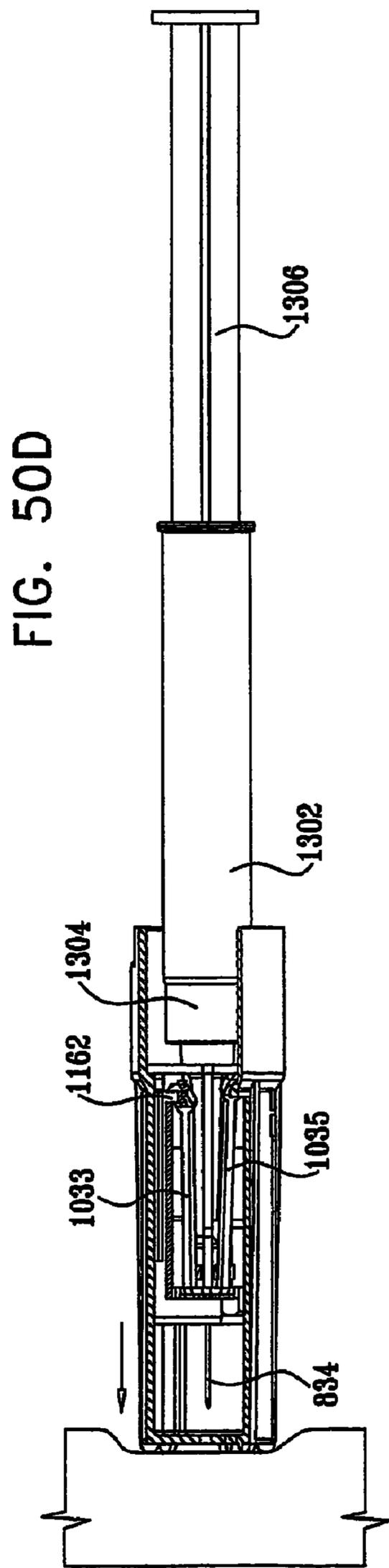
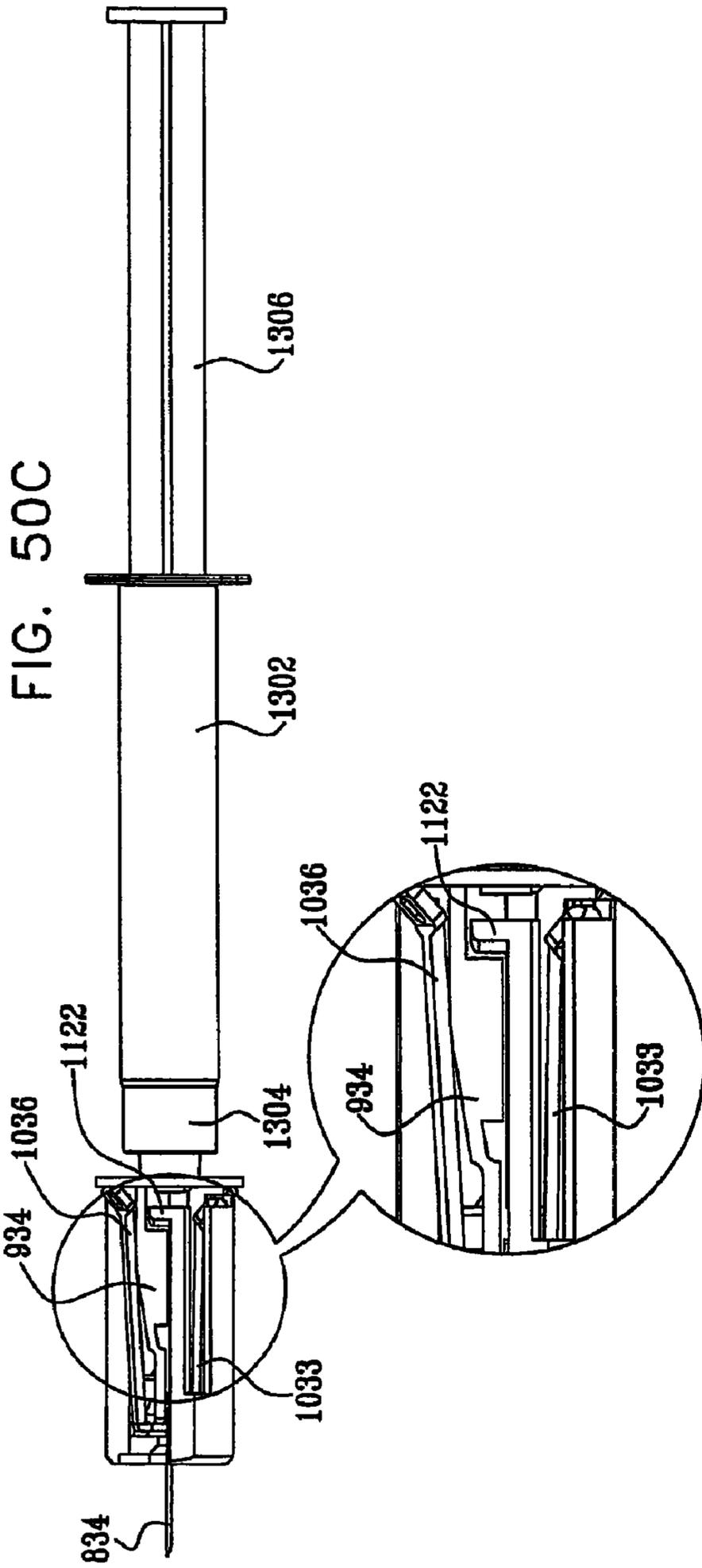


FIG. 48







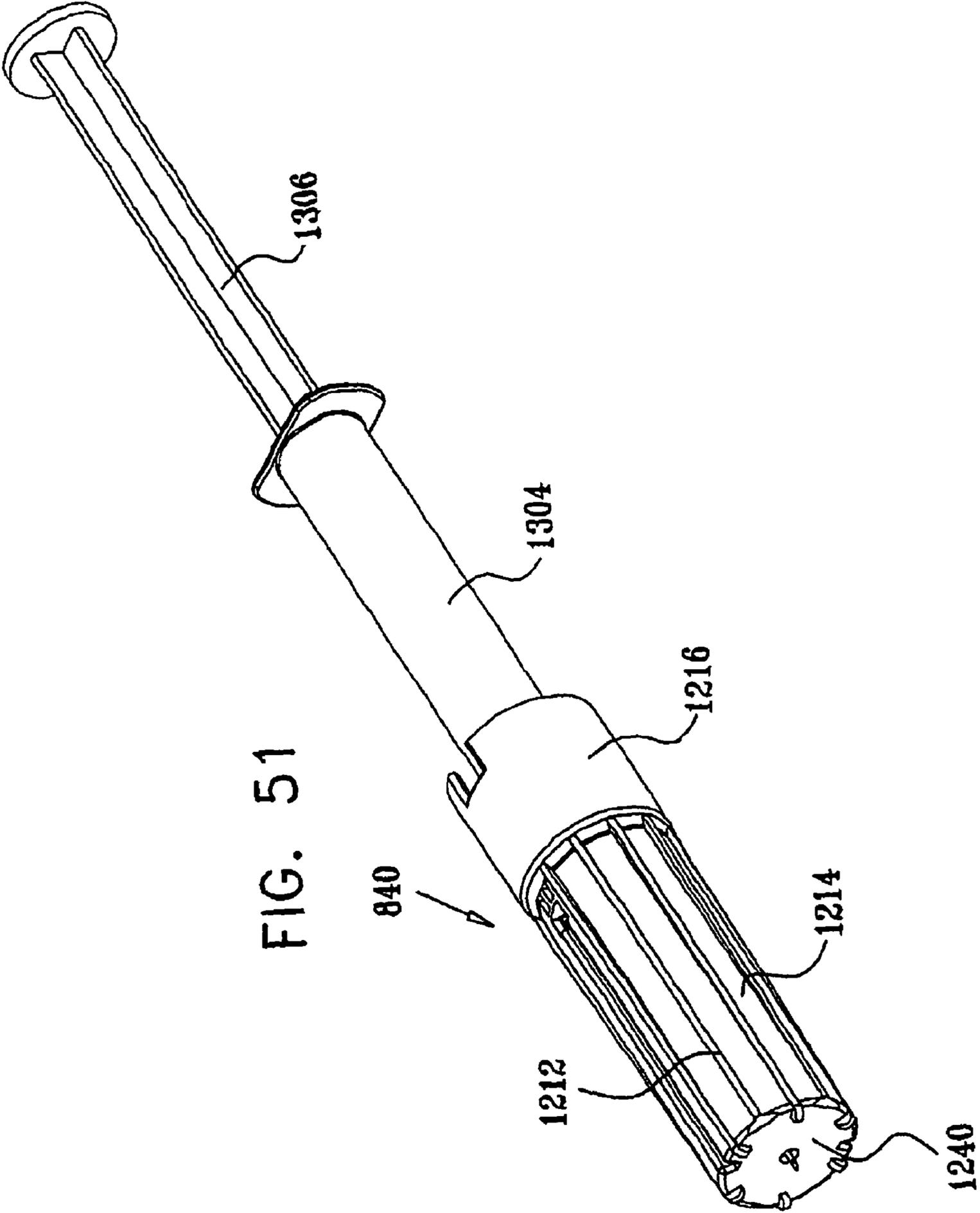
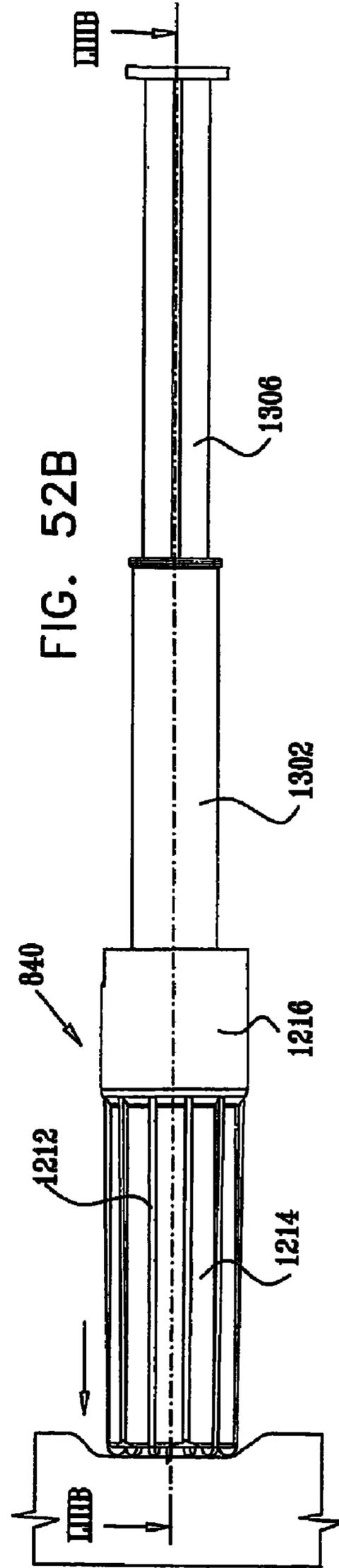
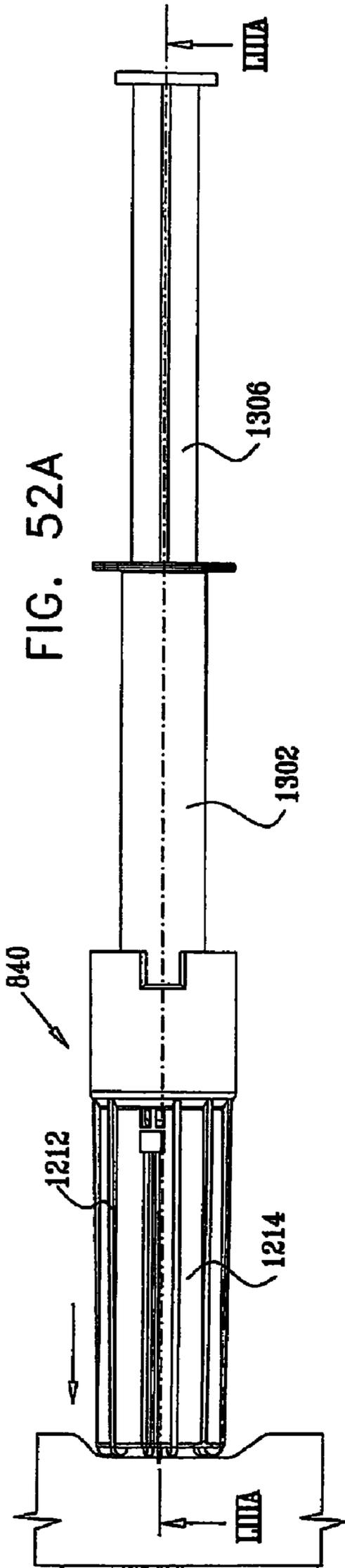
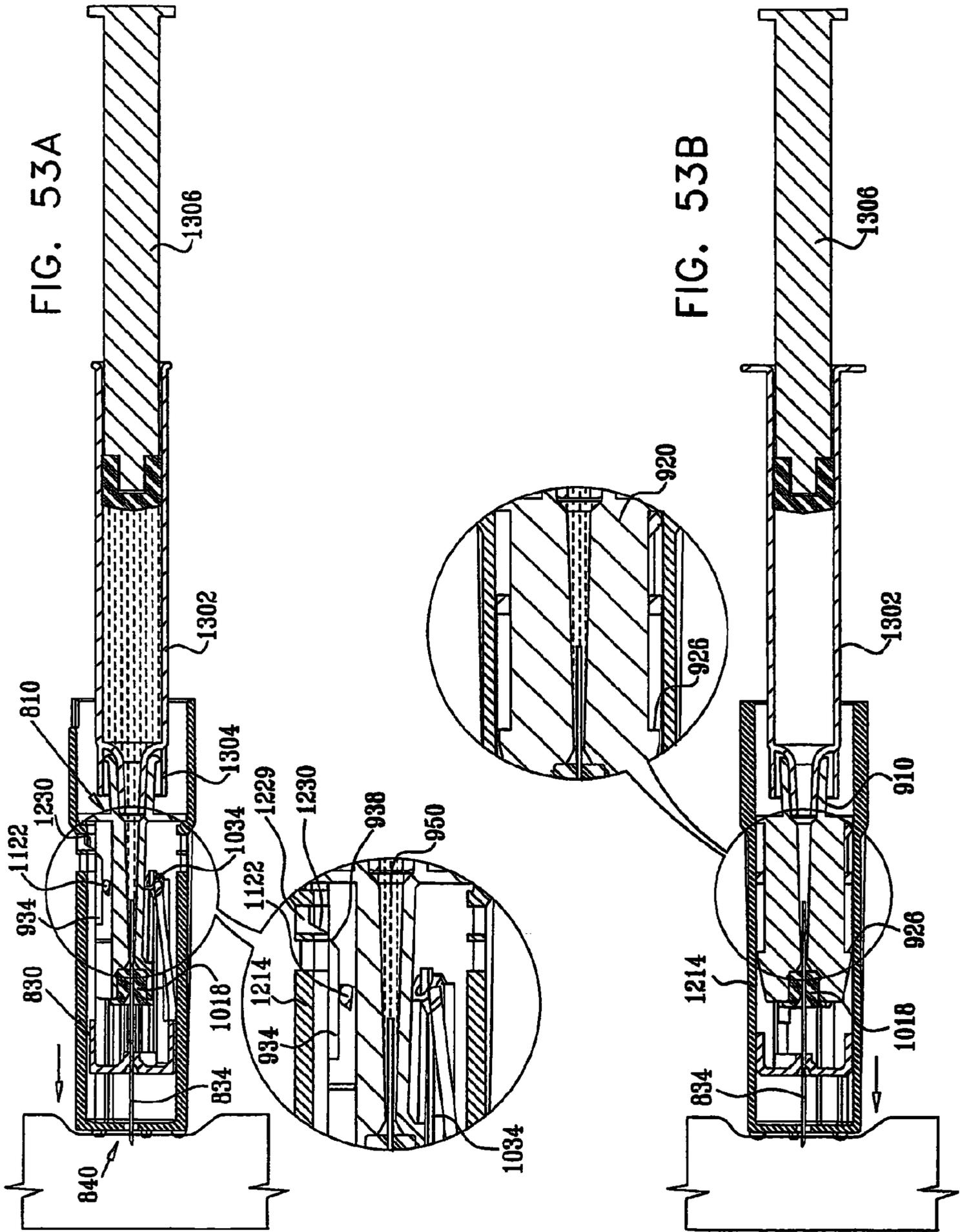


FIG. 51





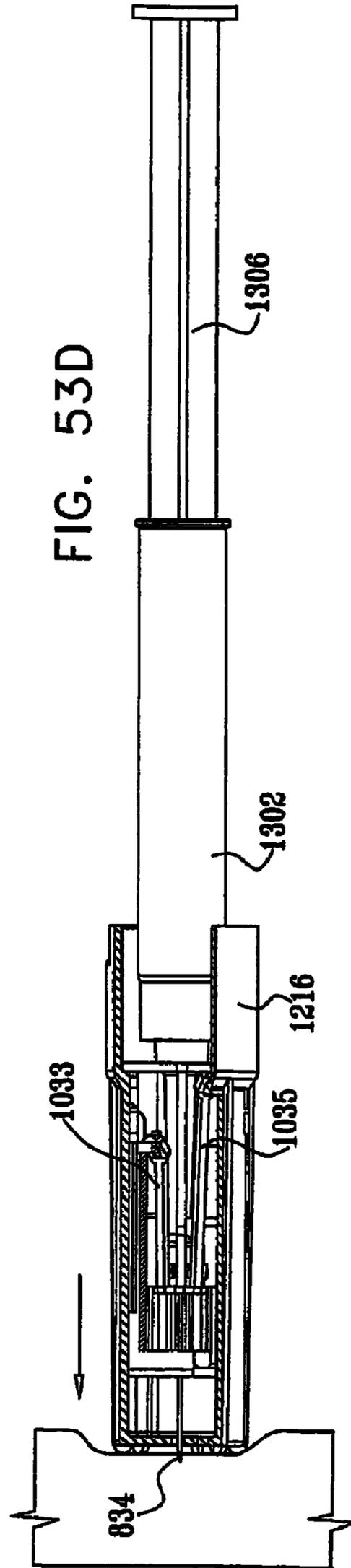
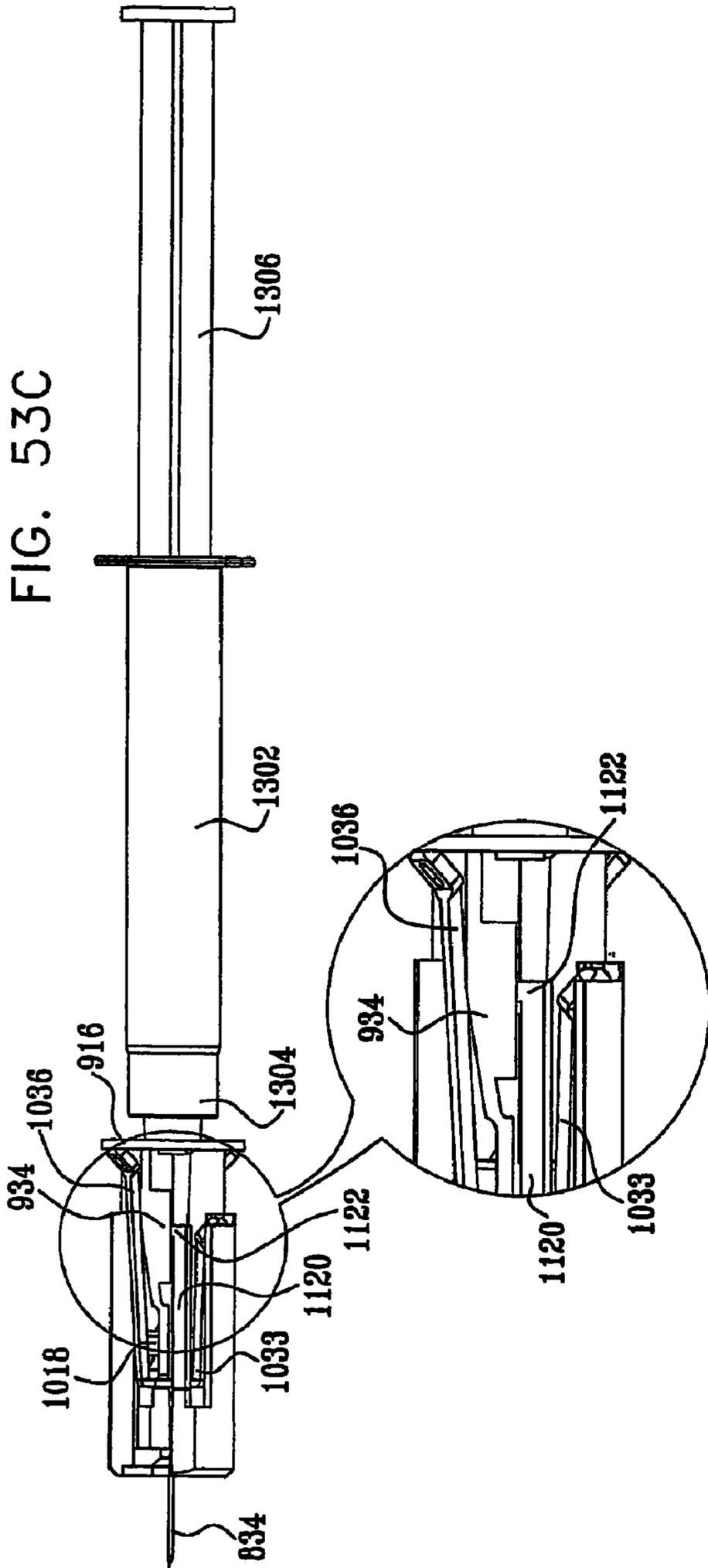
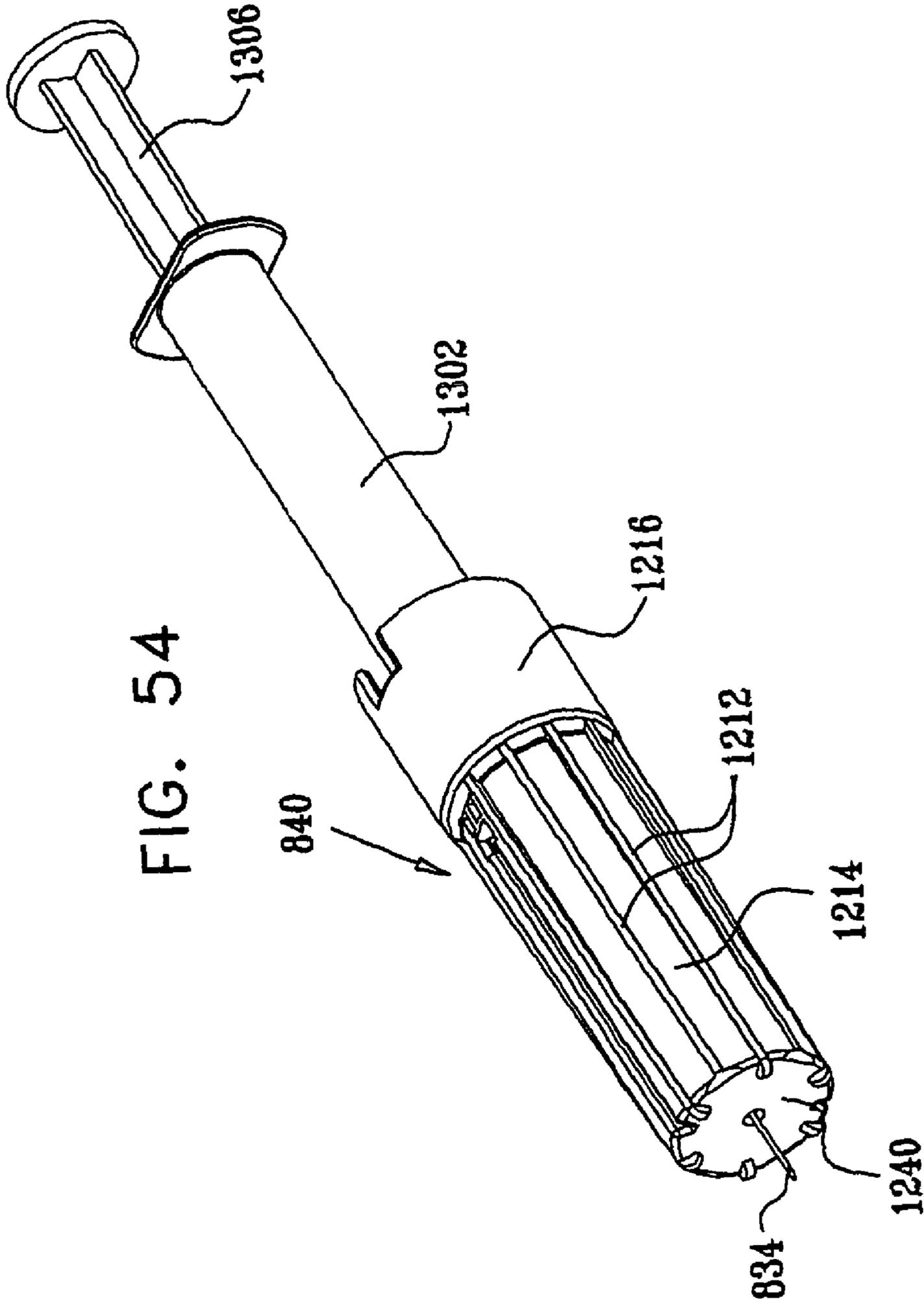
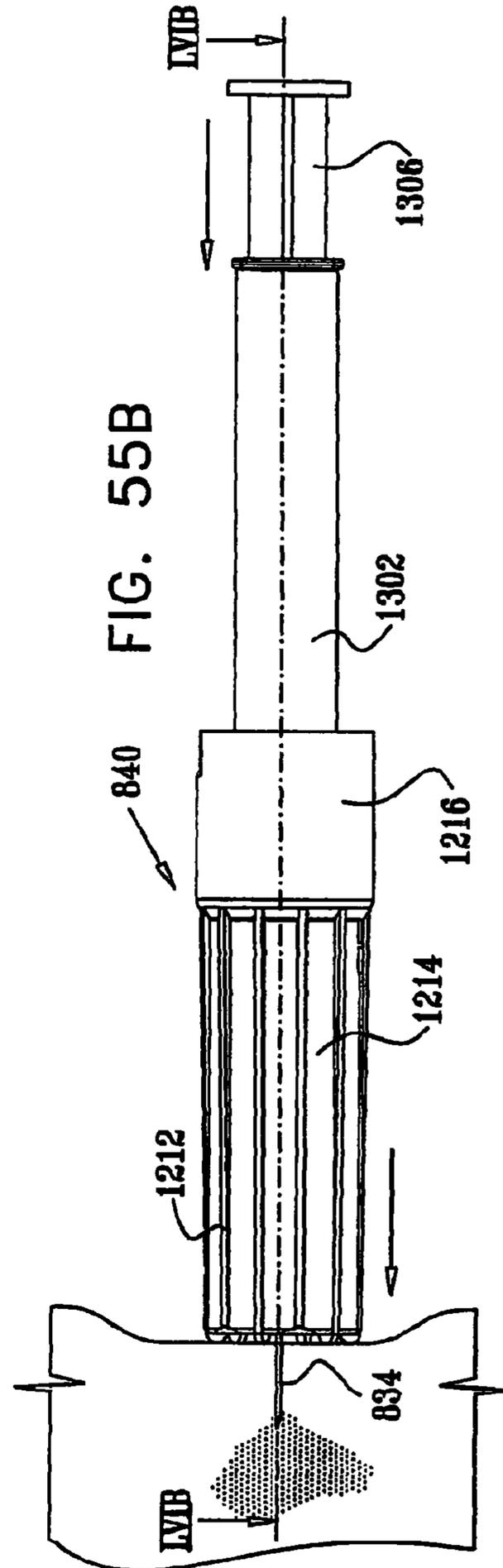
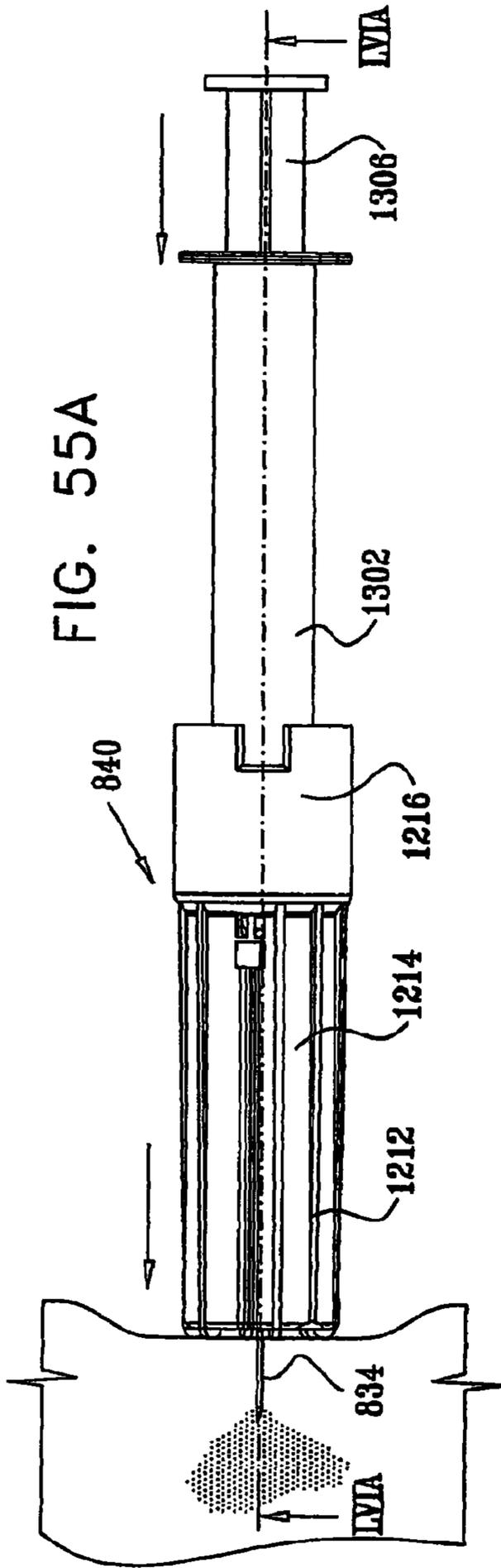
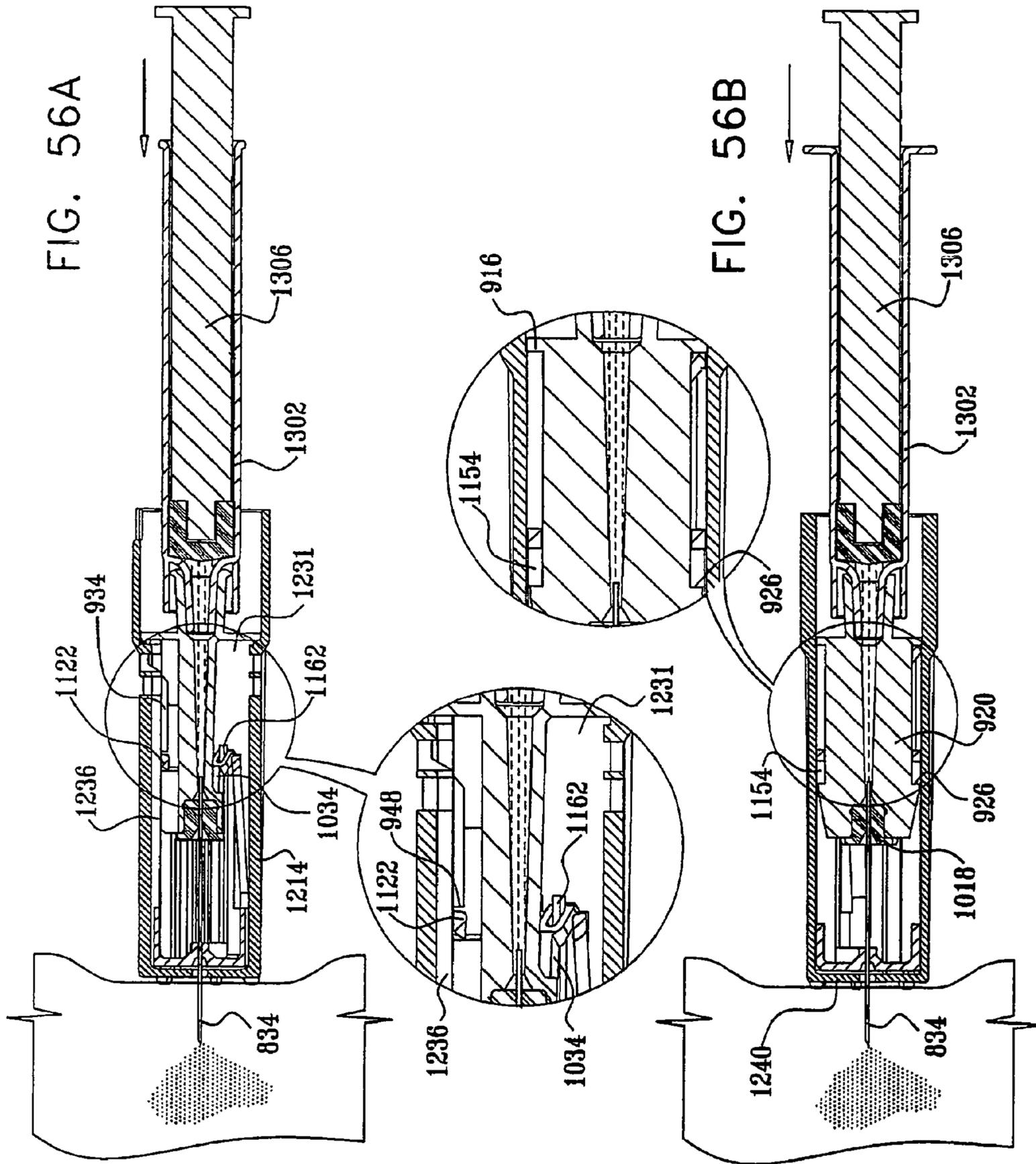
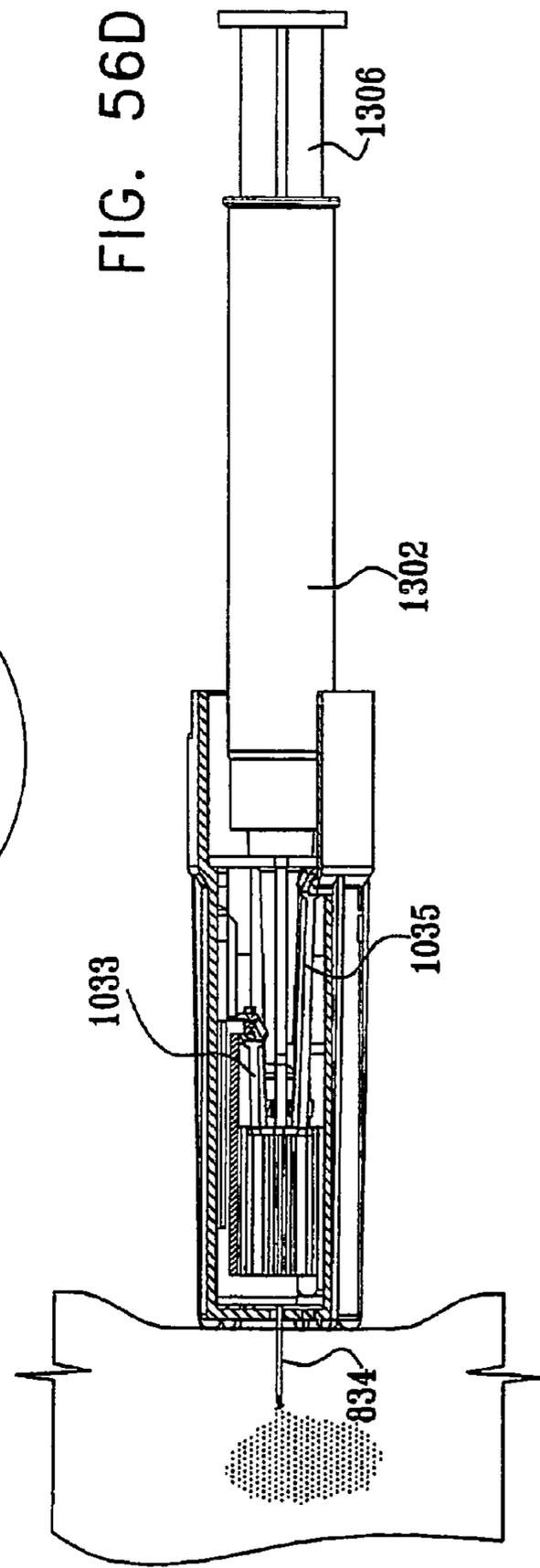
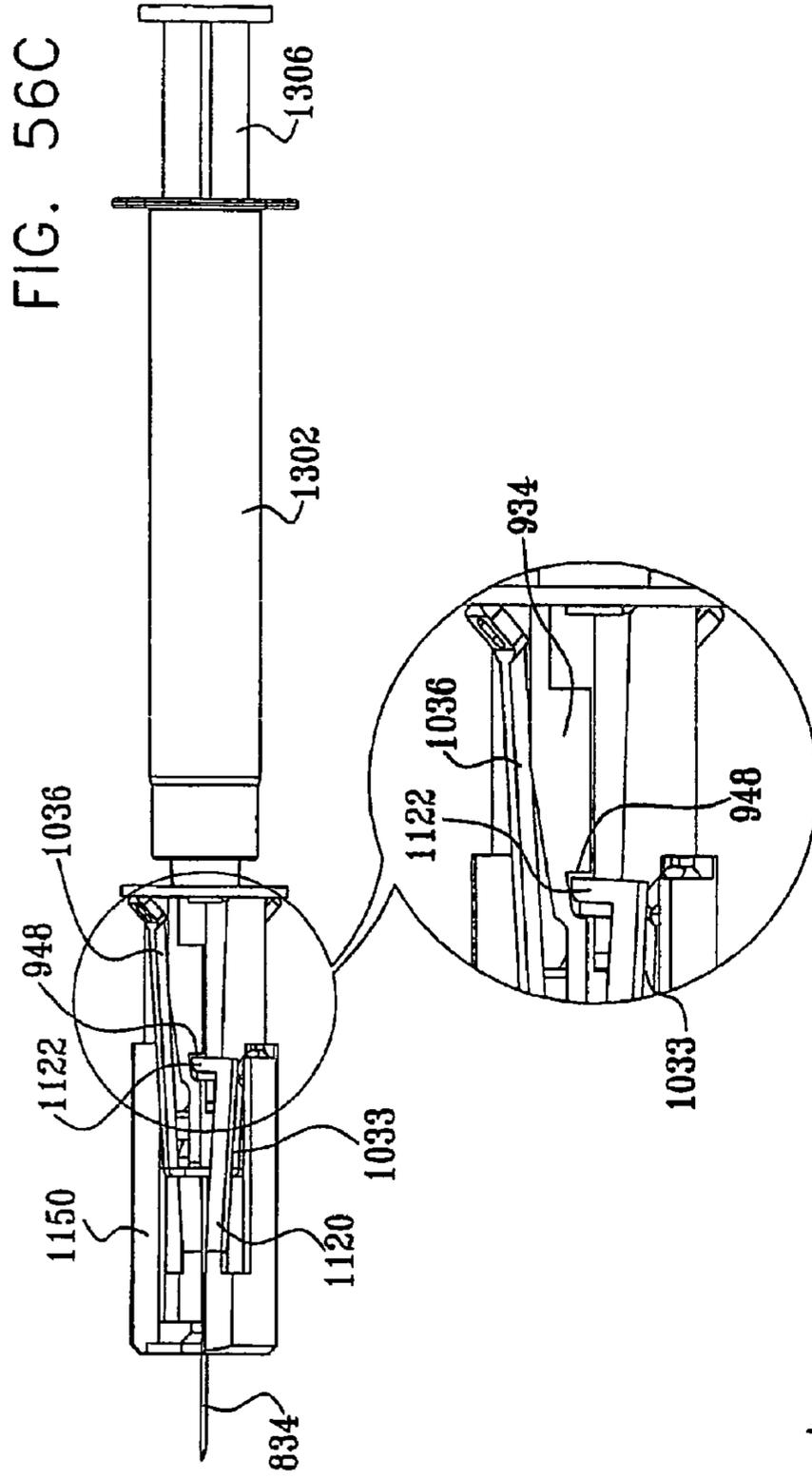


FIG. 54









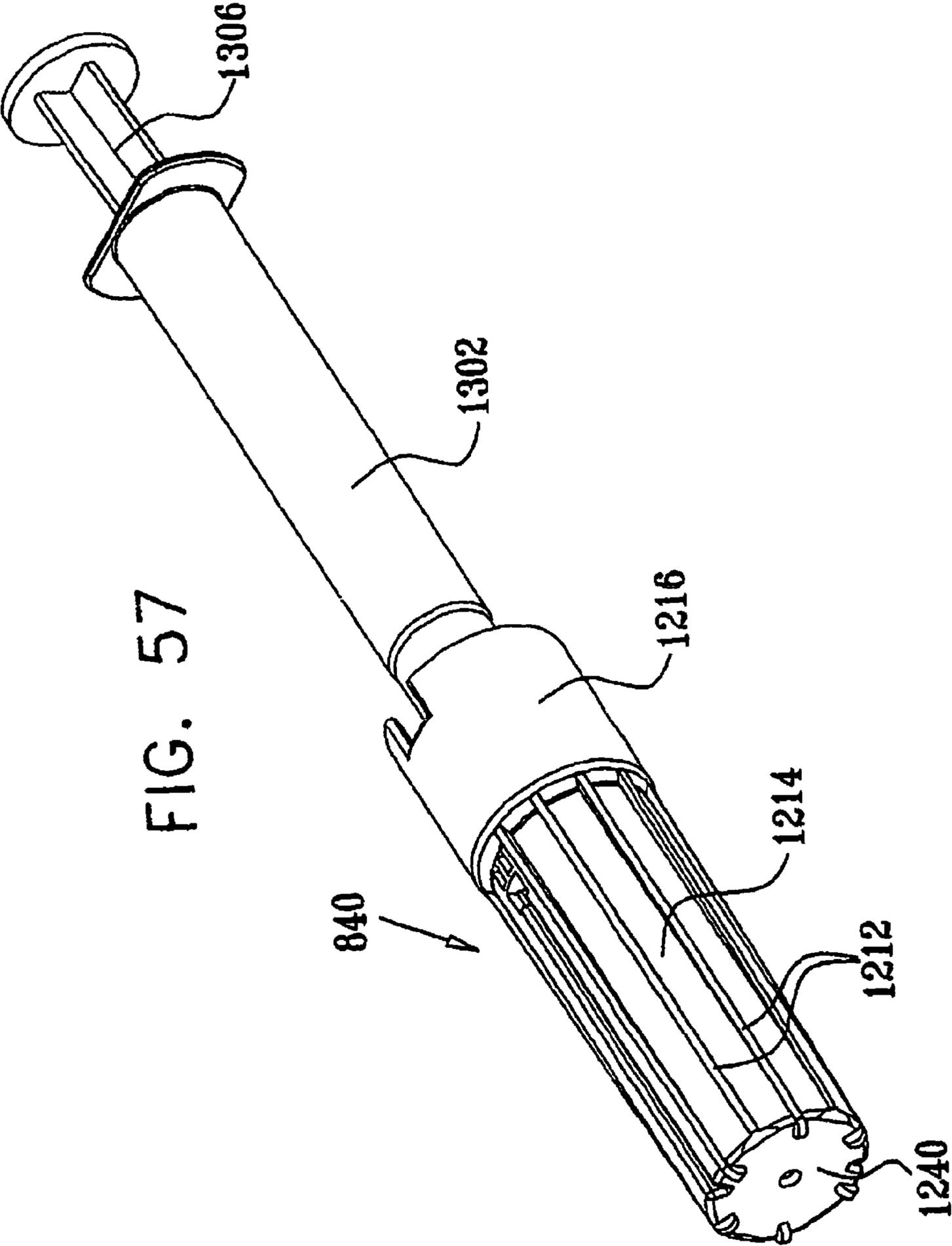
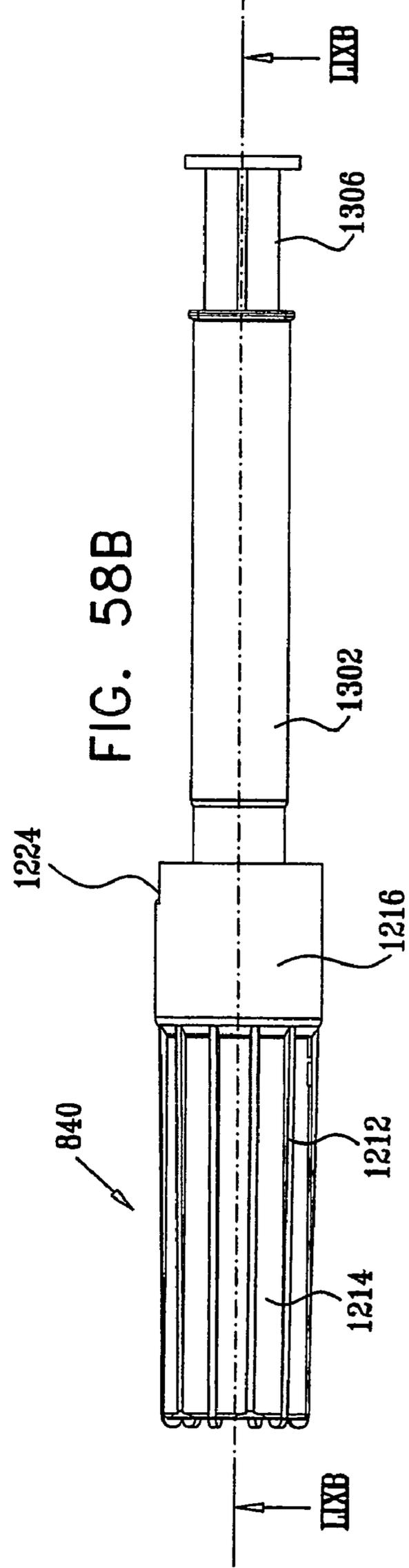
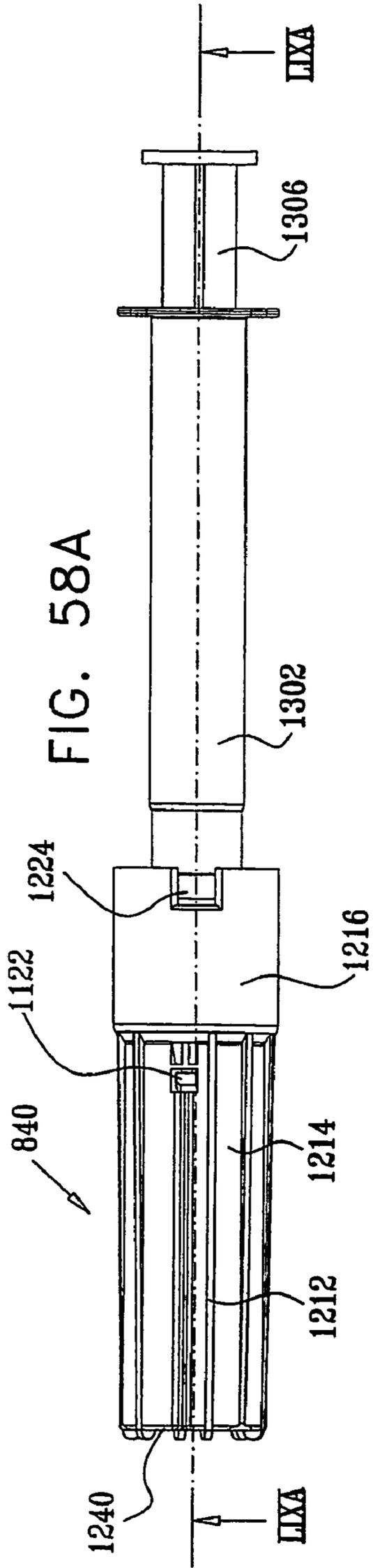
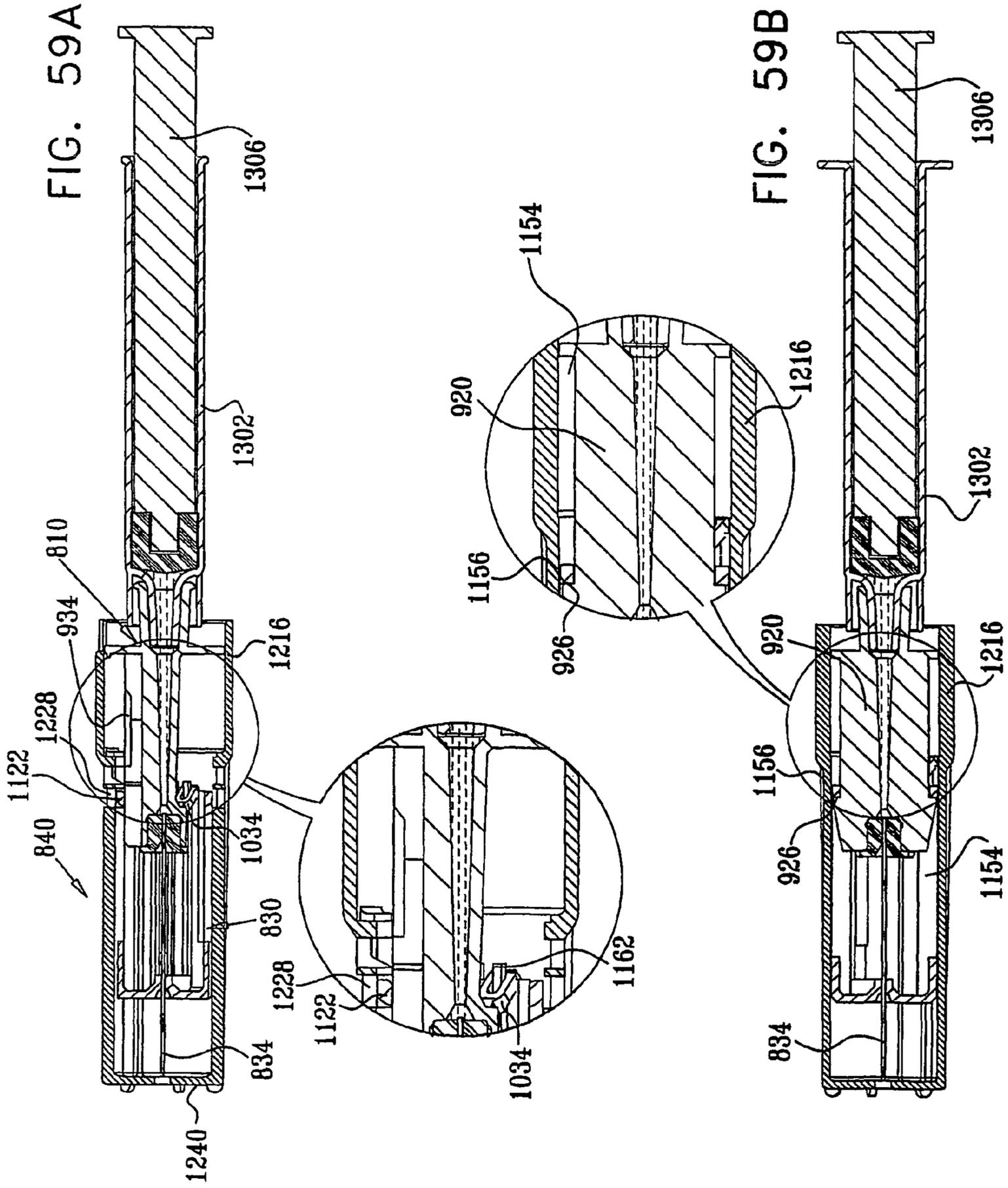


FIG. 57





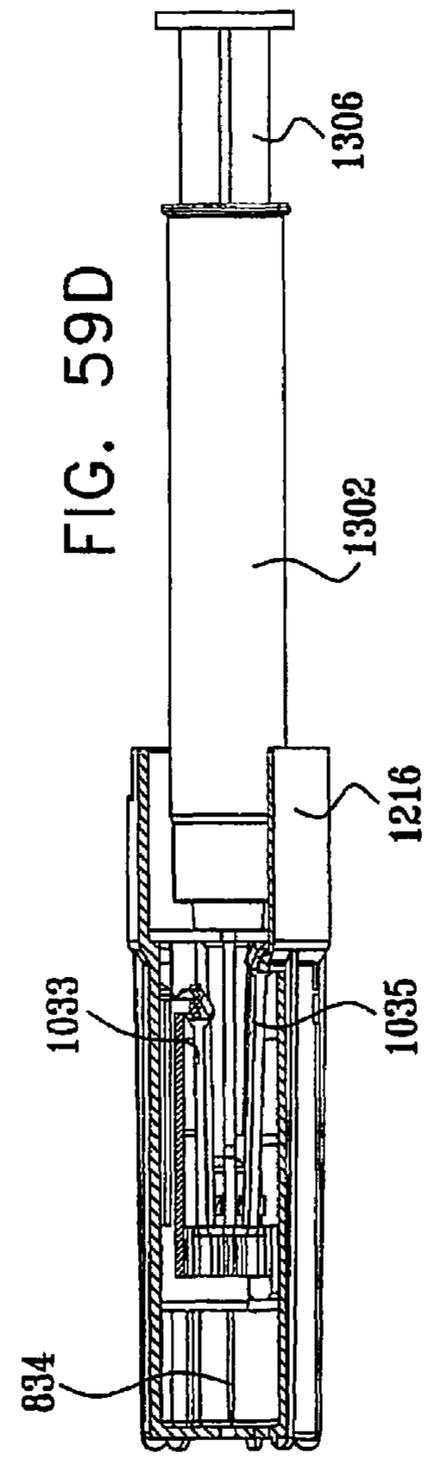
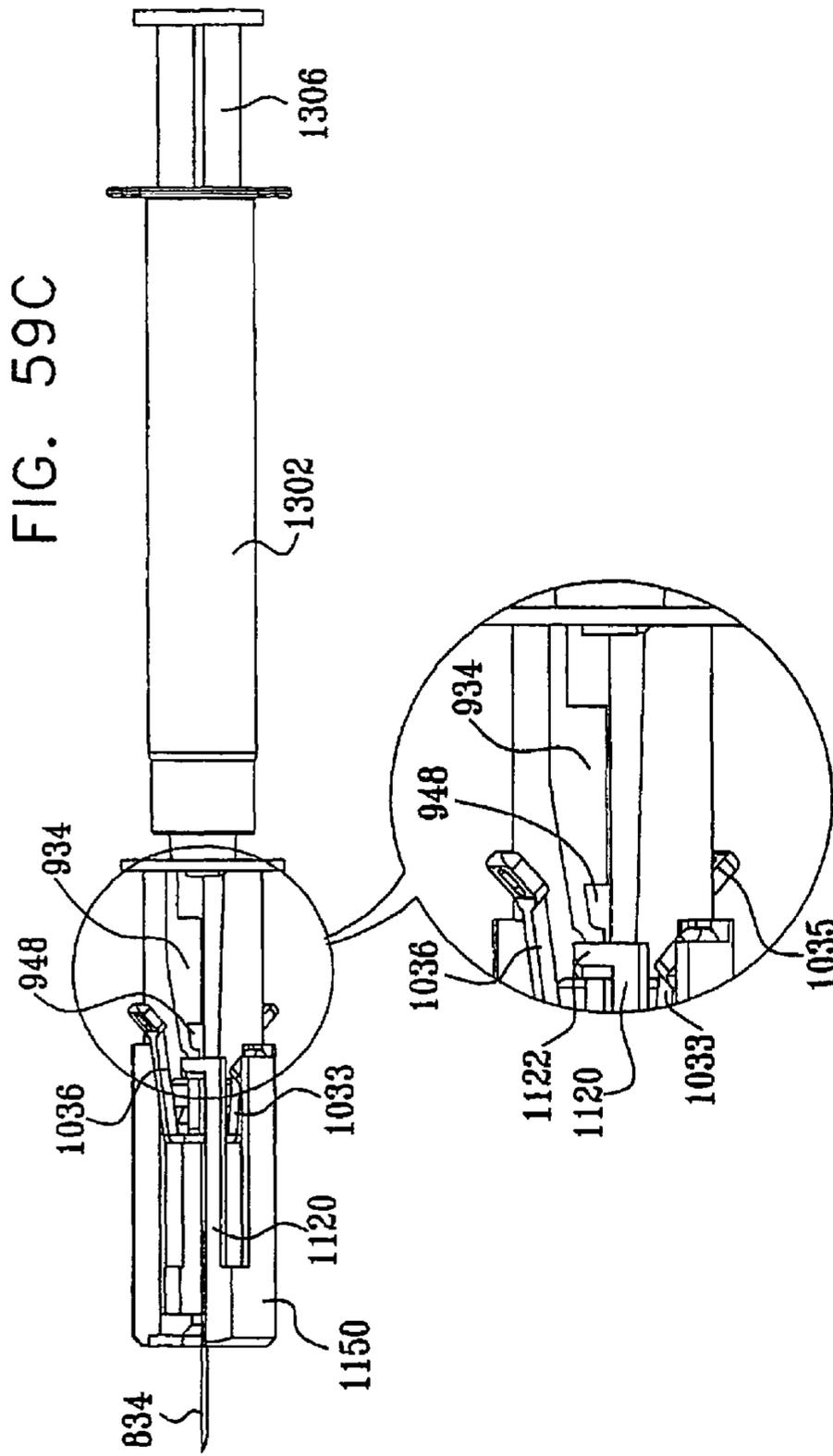


FIG. 60

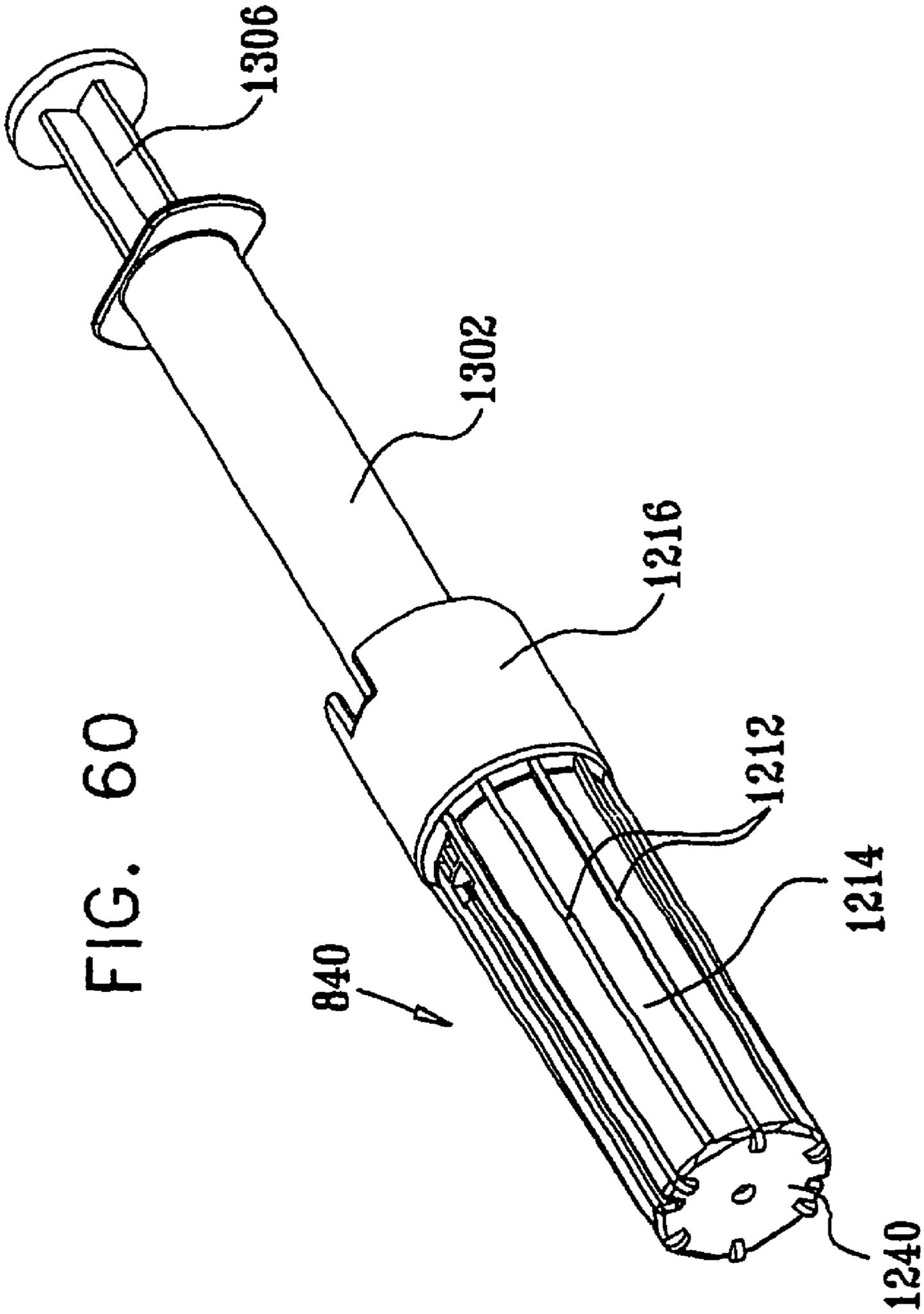


FIG. 61A

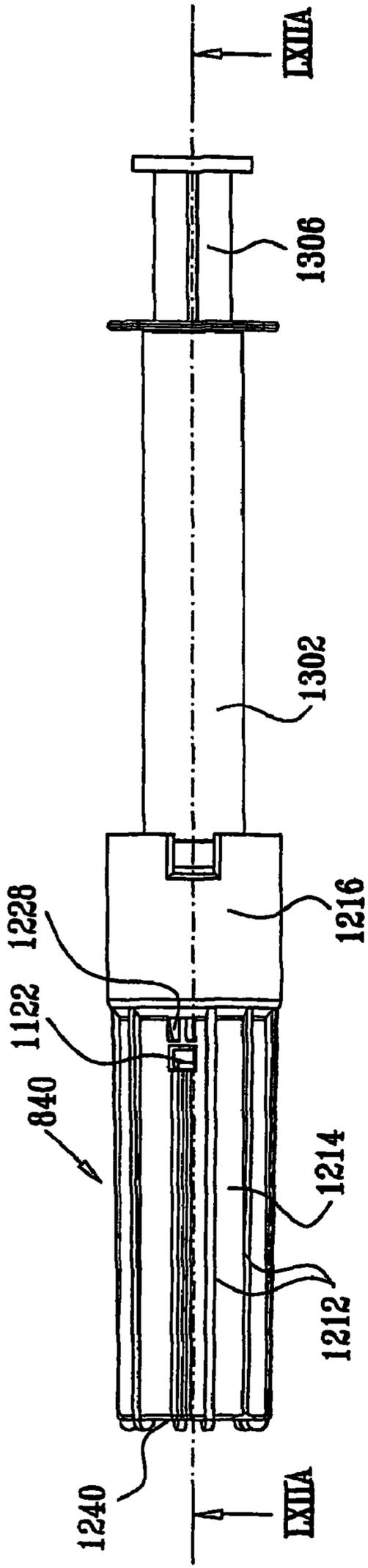
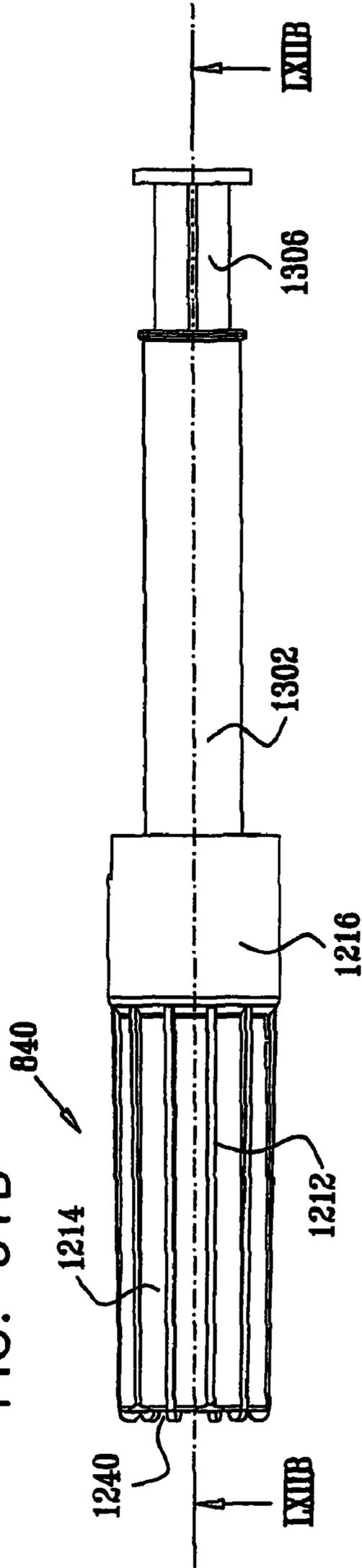
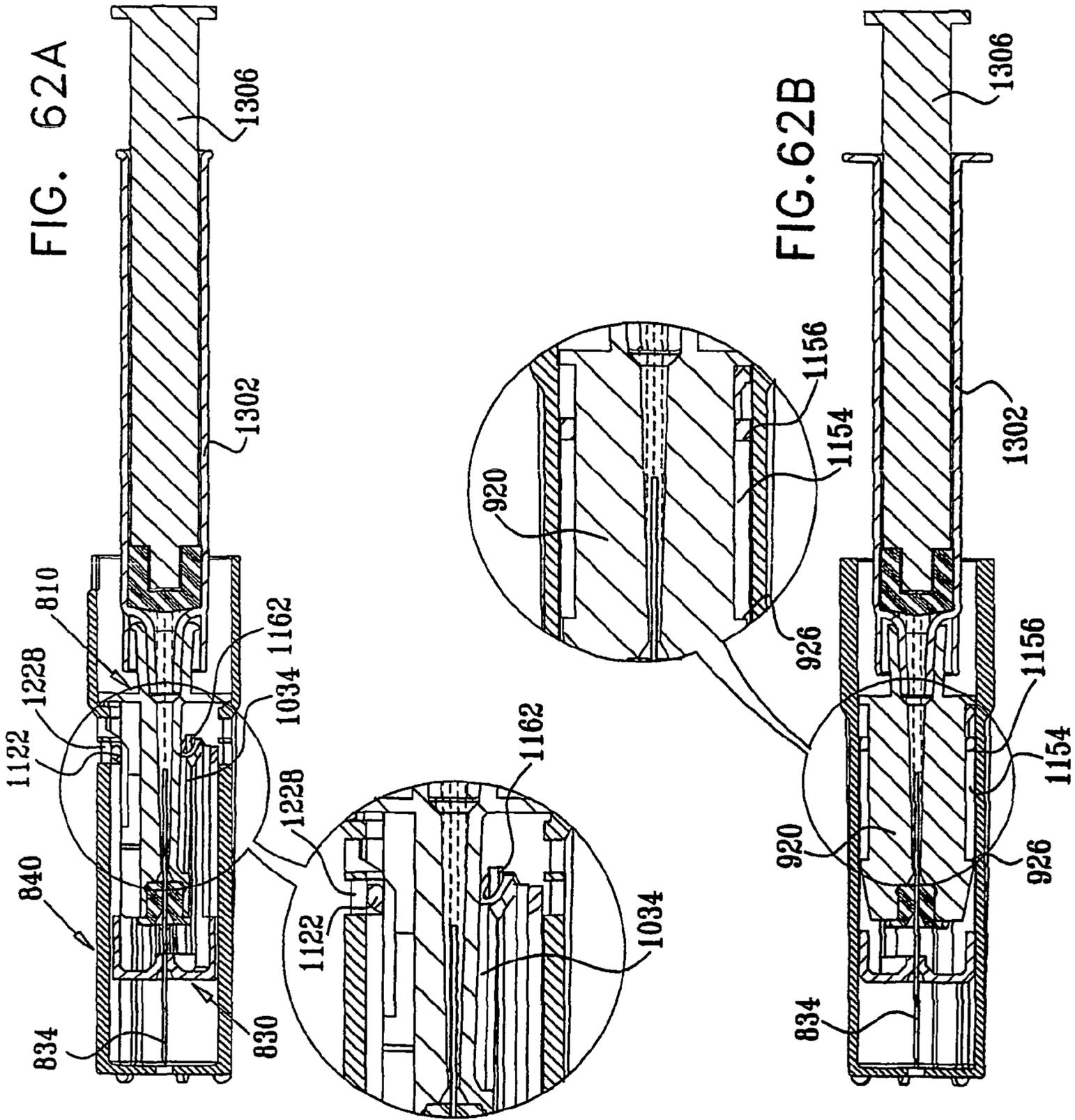
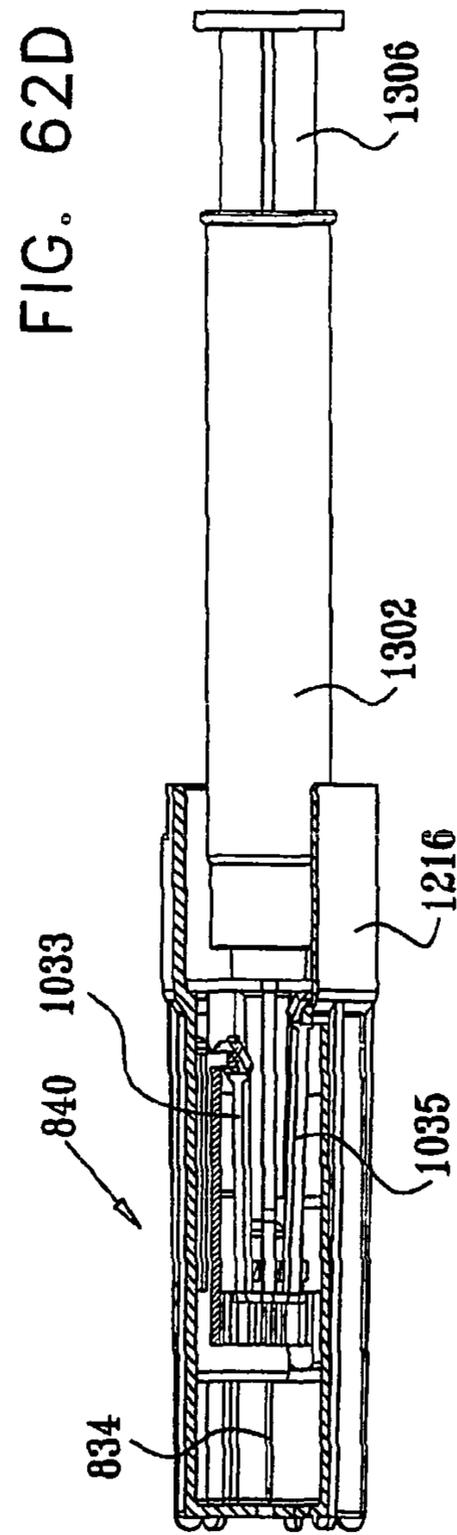
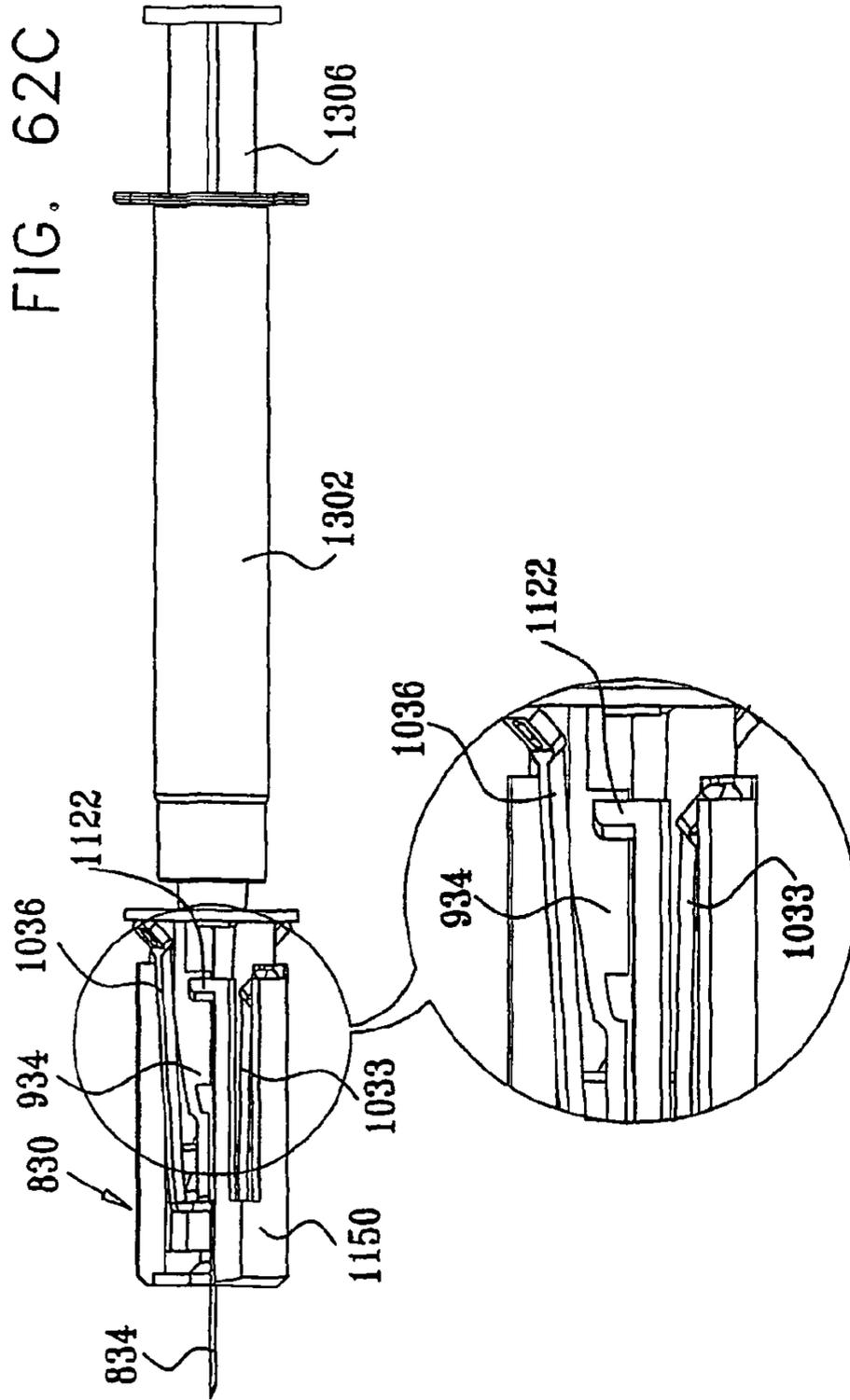
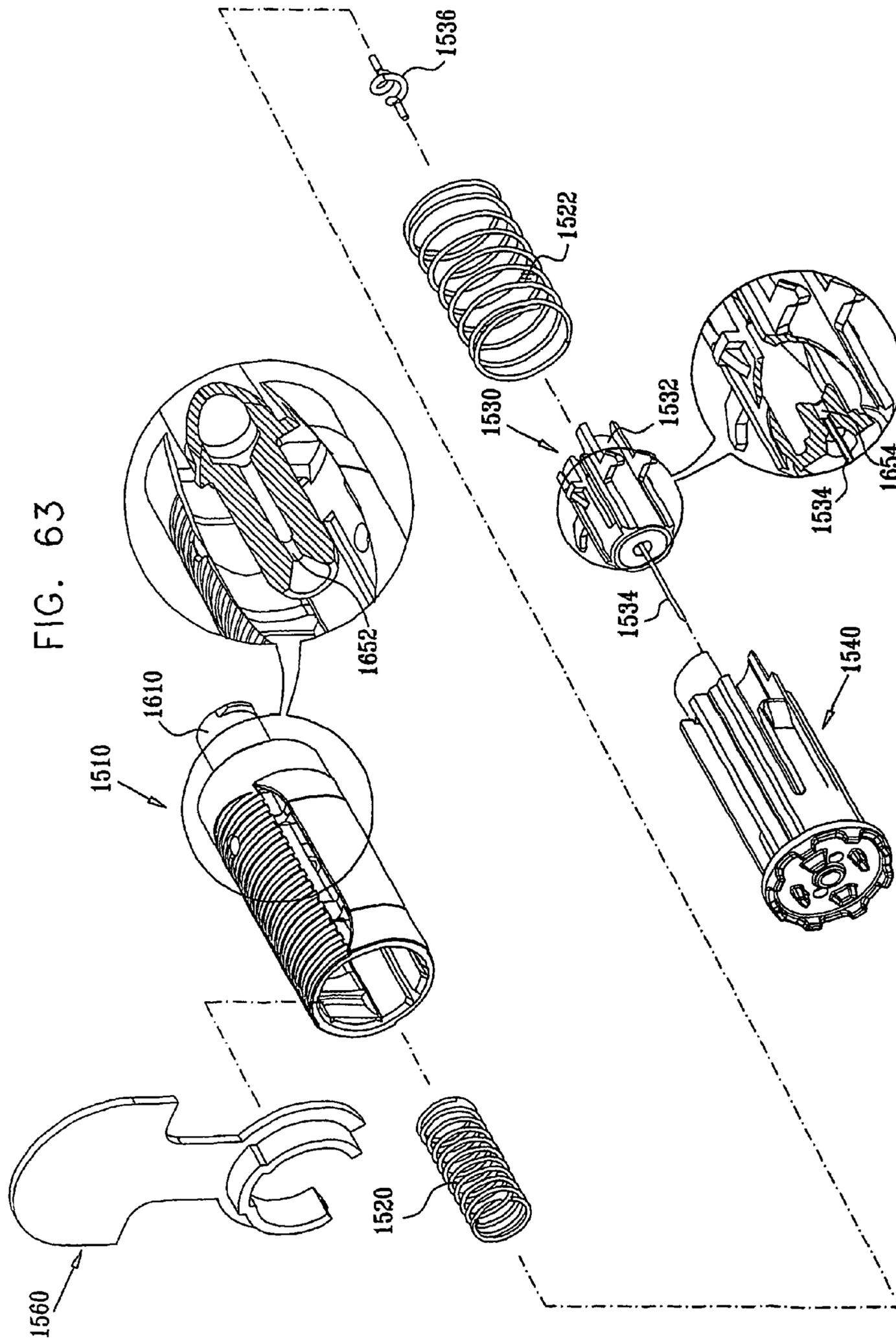


FIG. 61B









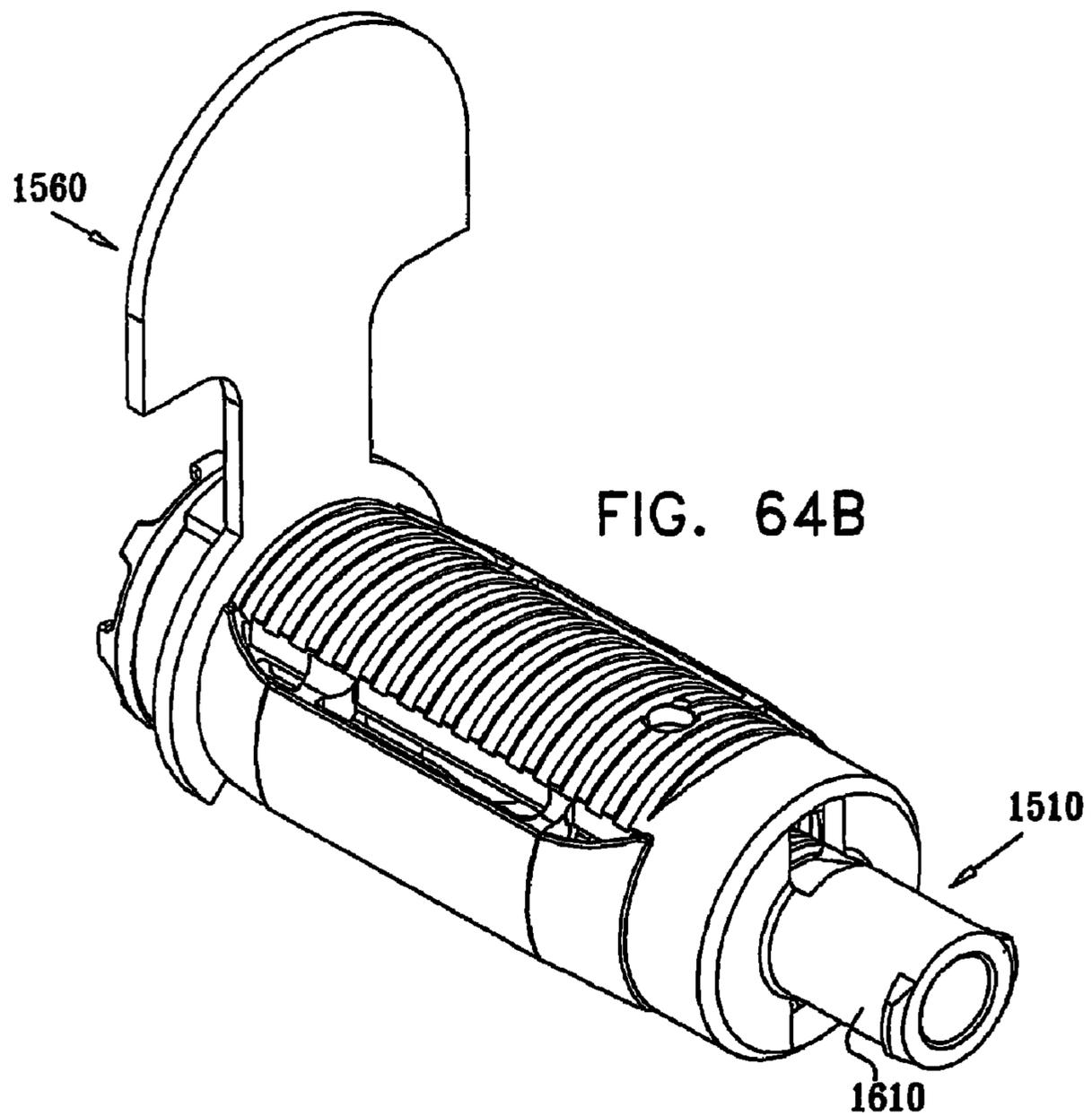
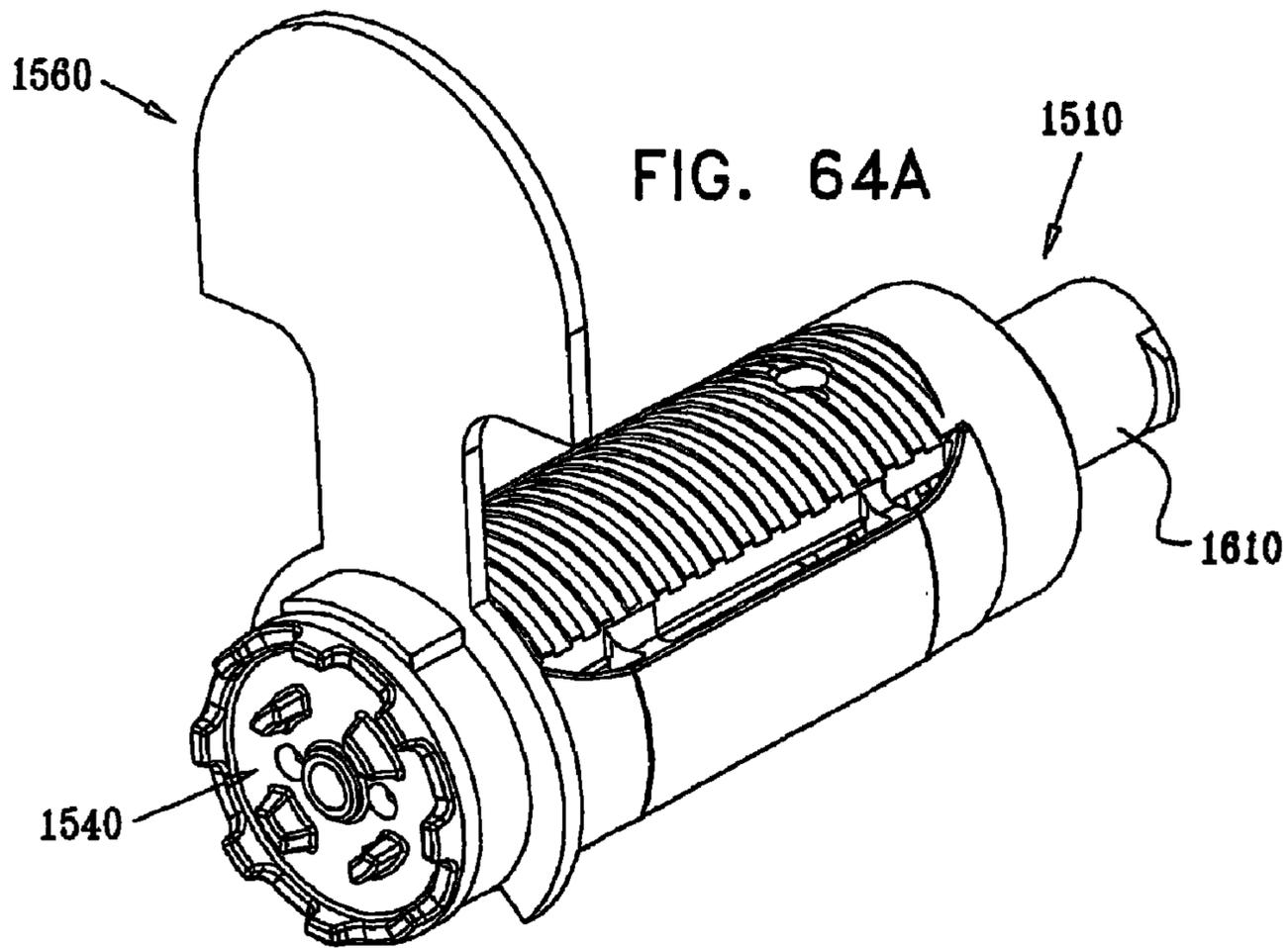


FIG. 65A

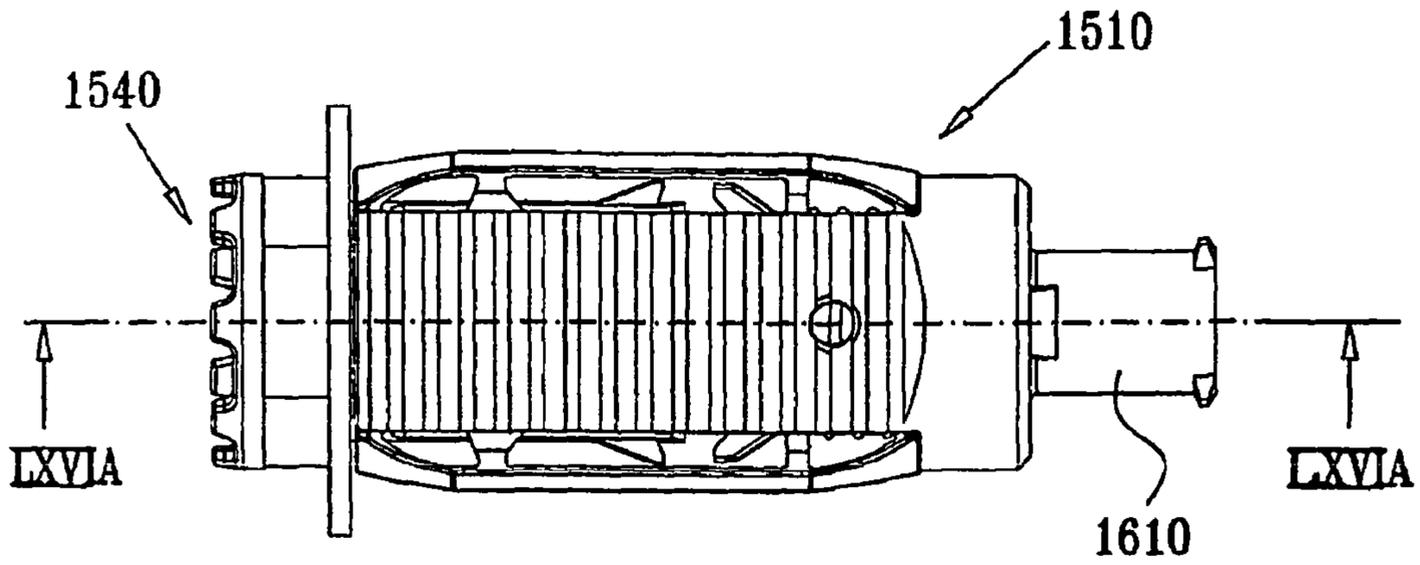
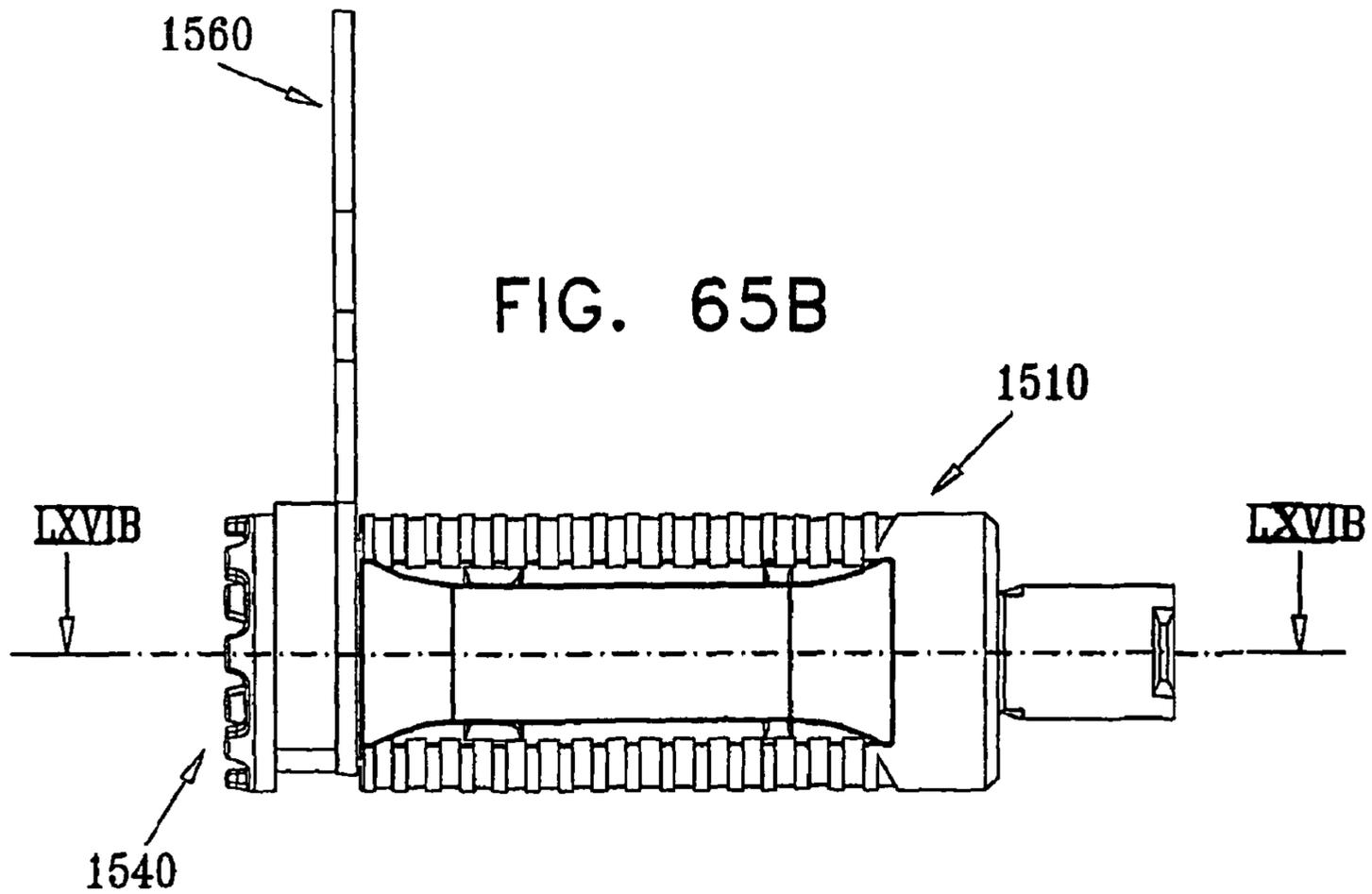
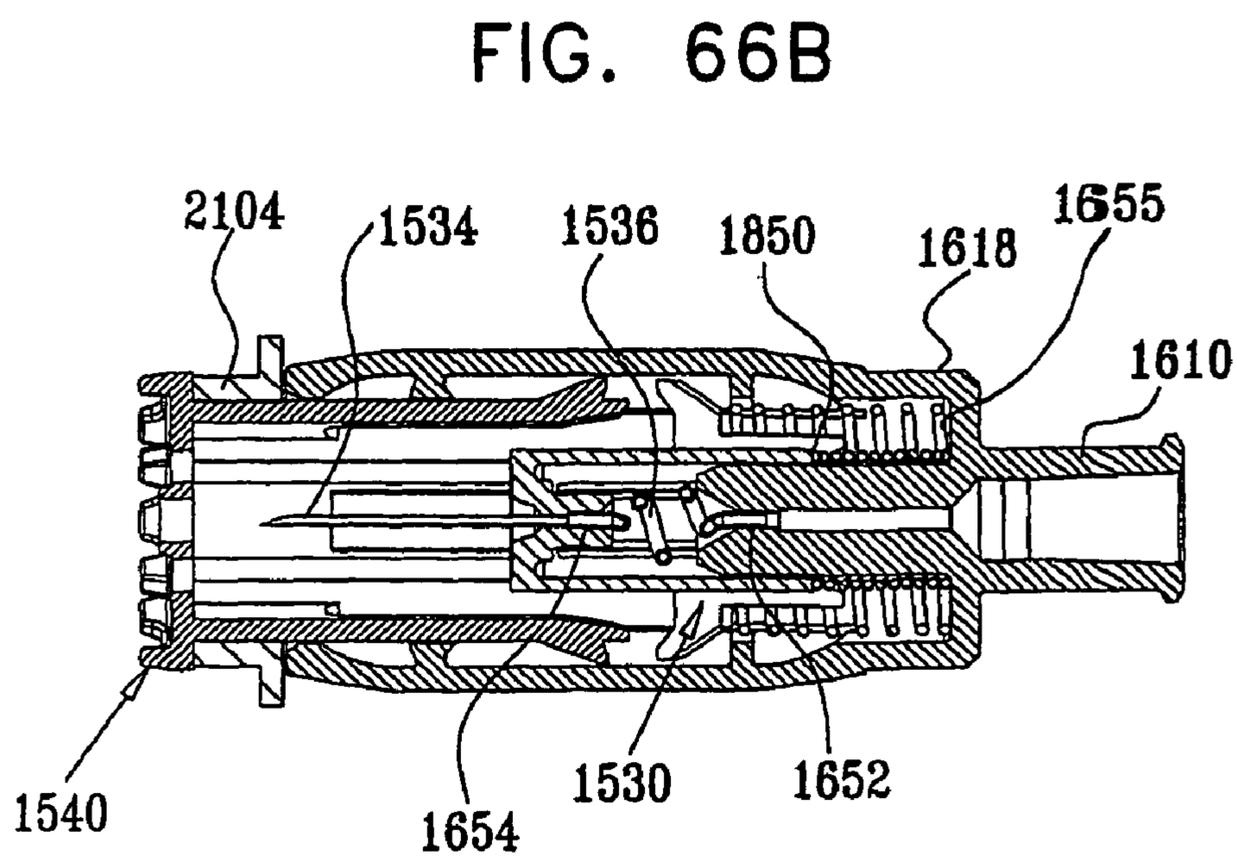
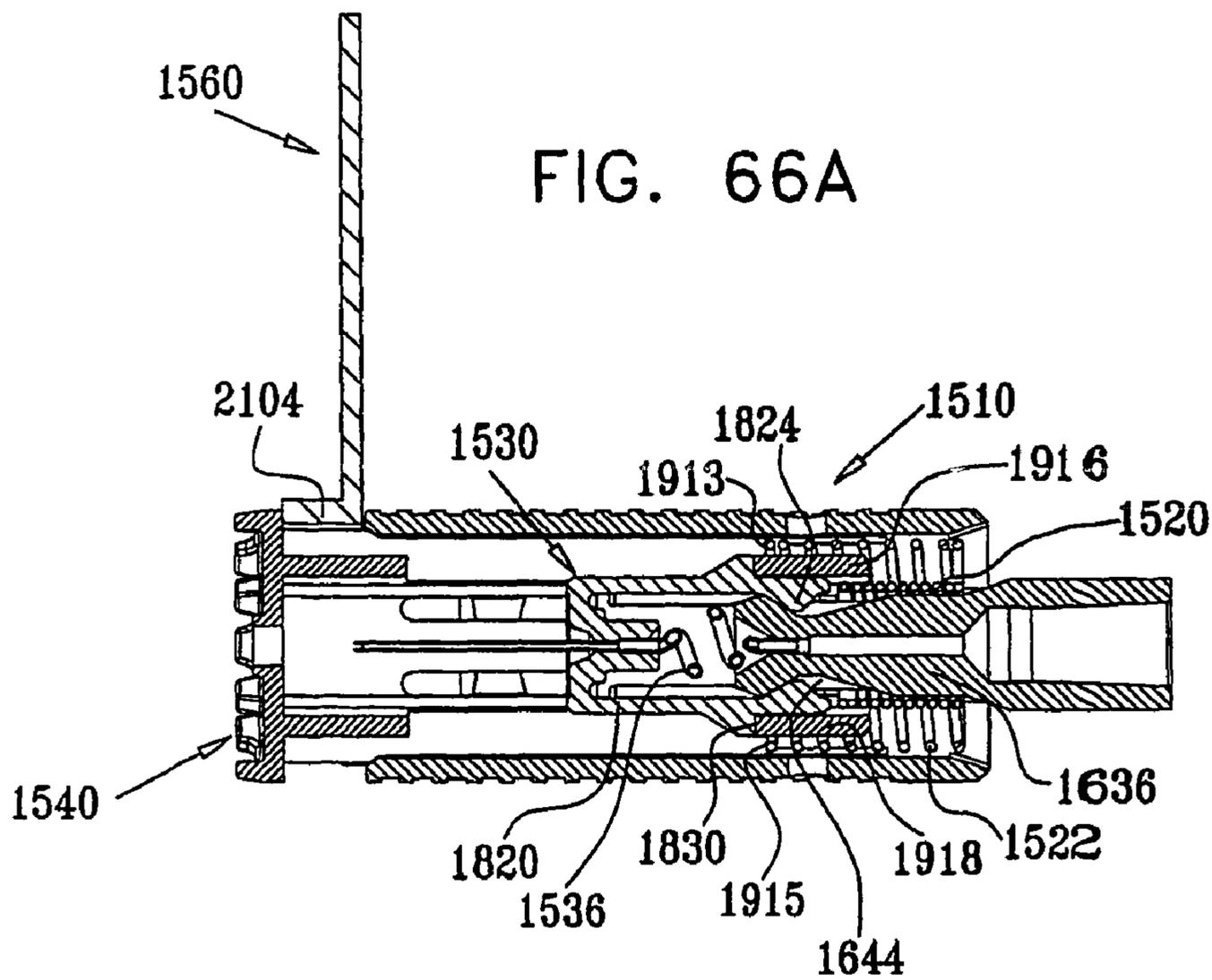


FIG. 65B





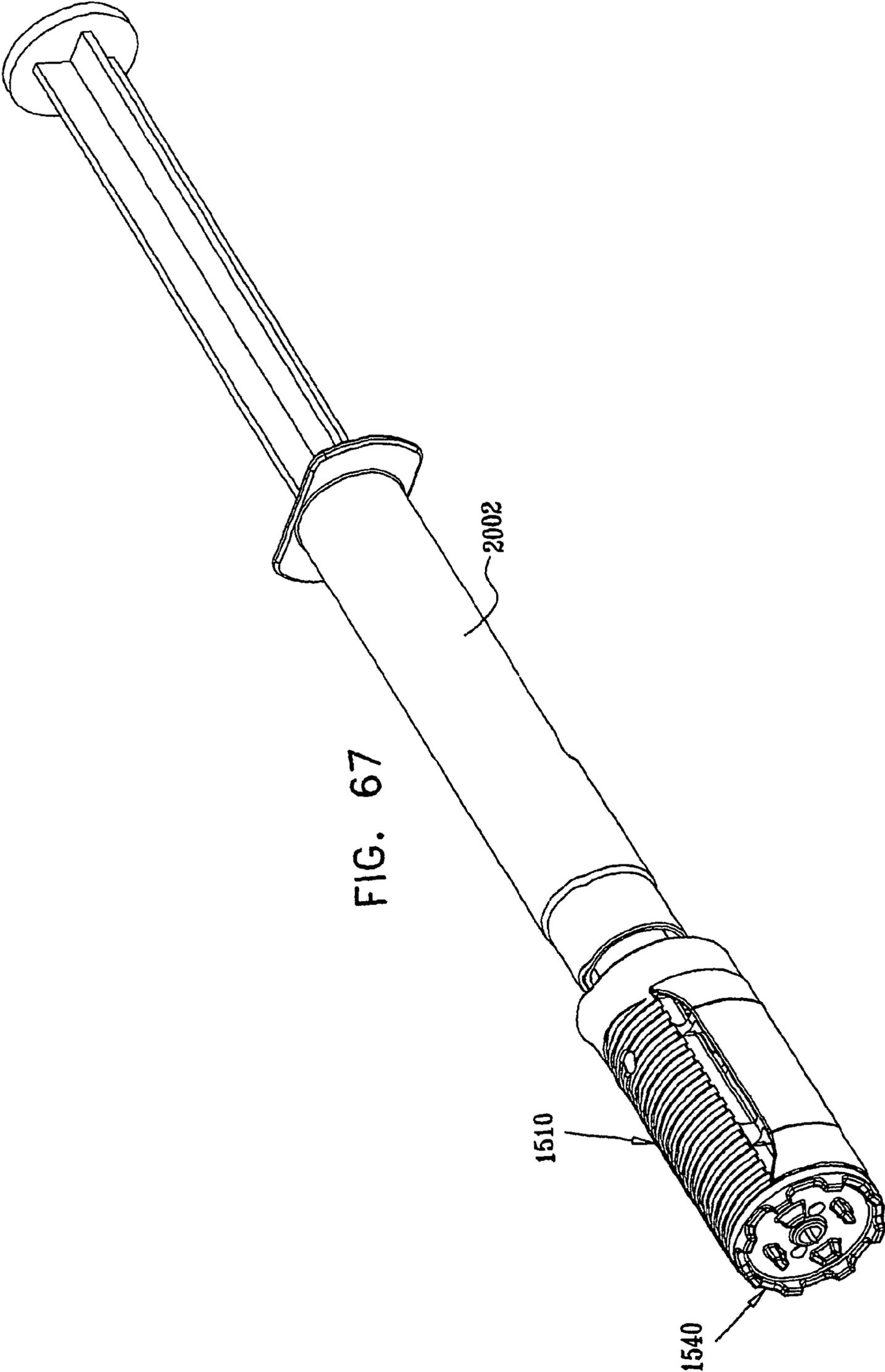
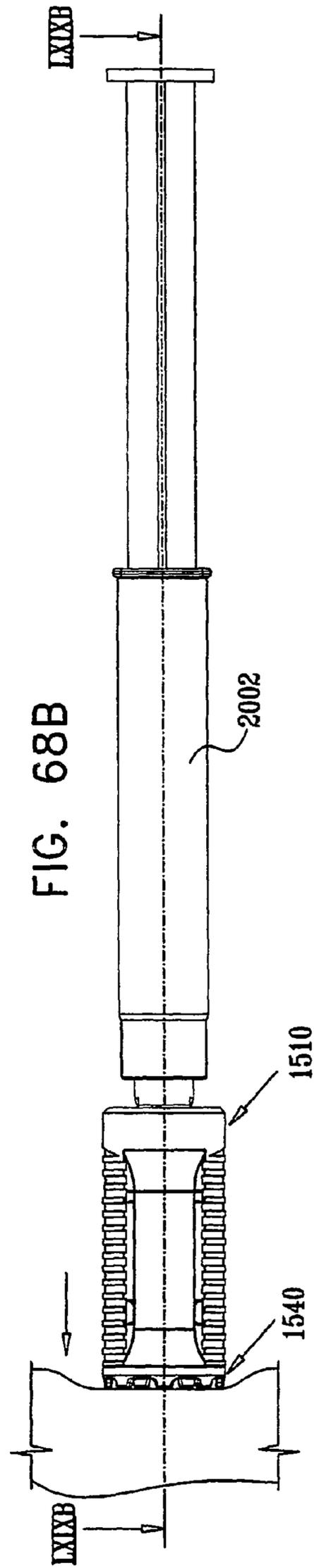
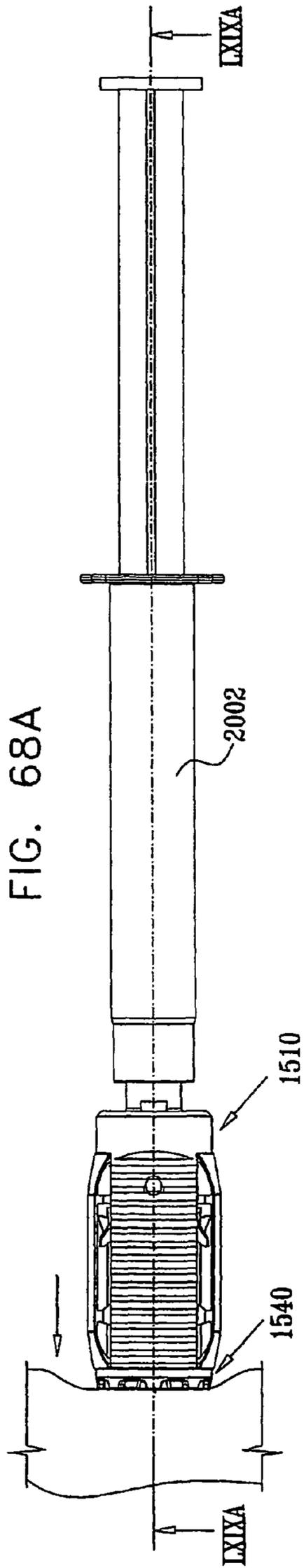
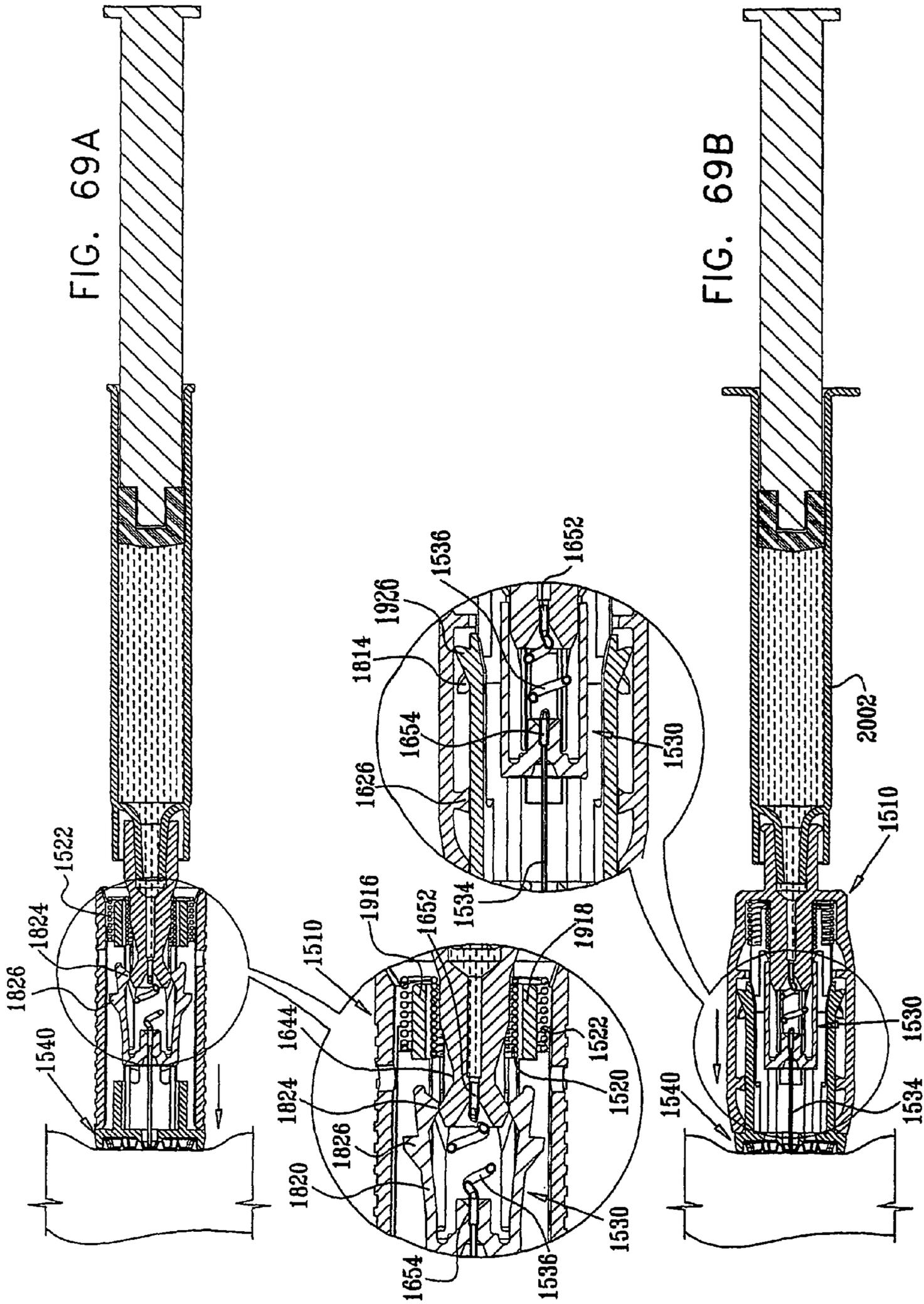


FIG. 67





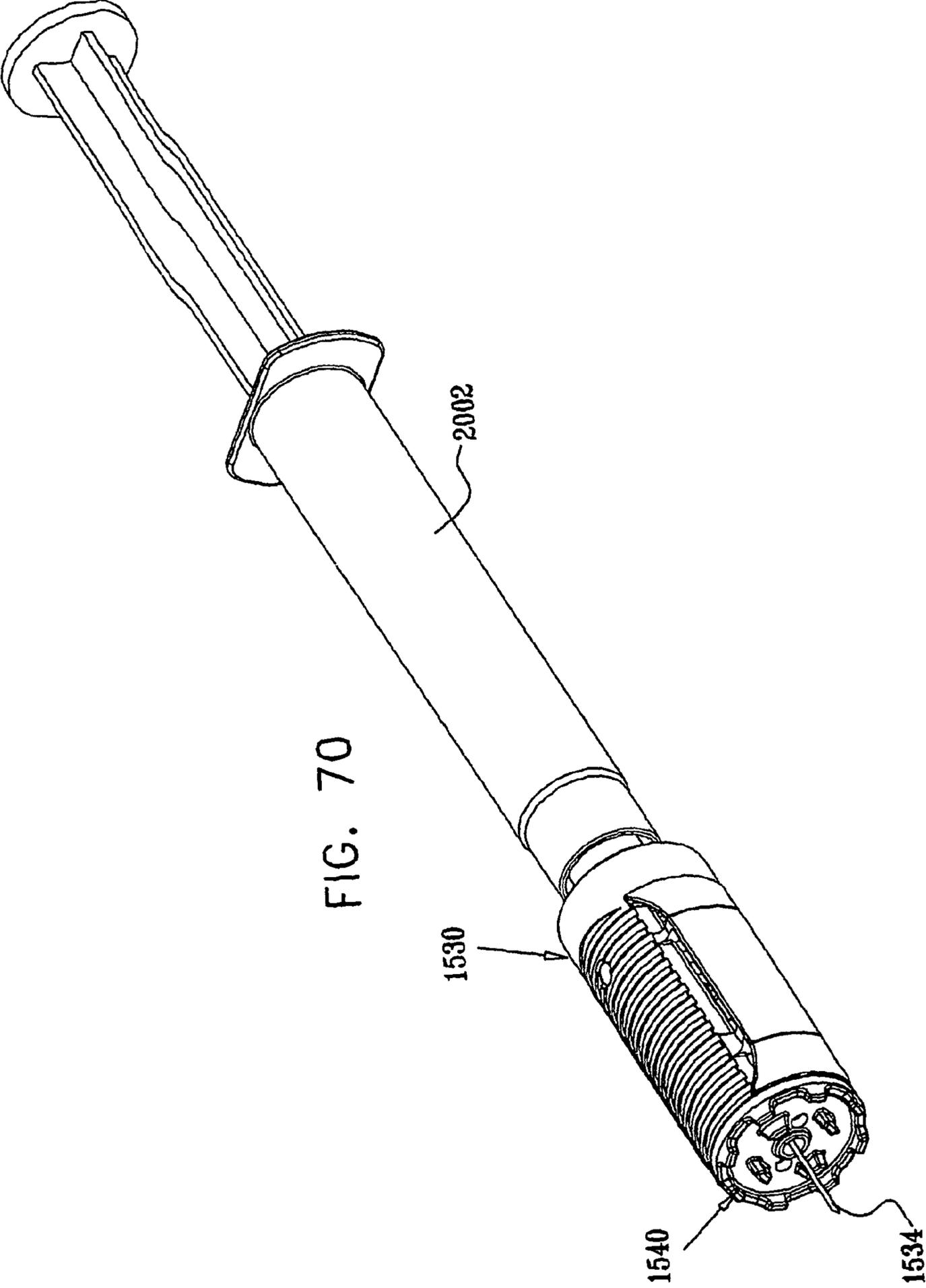
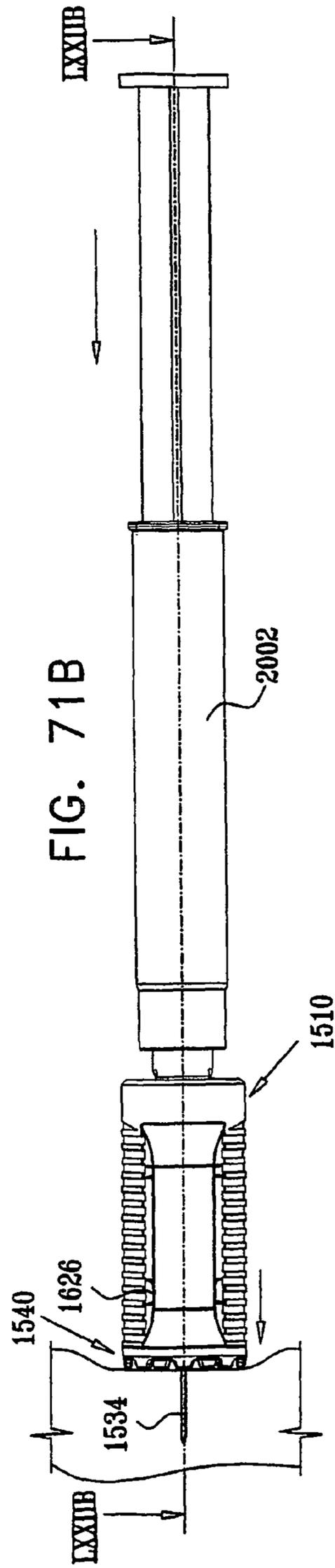
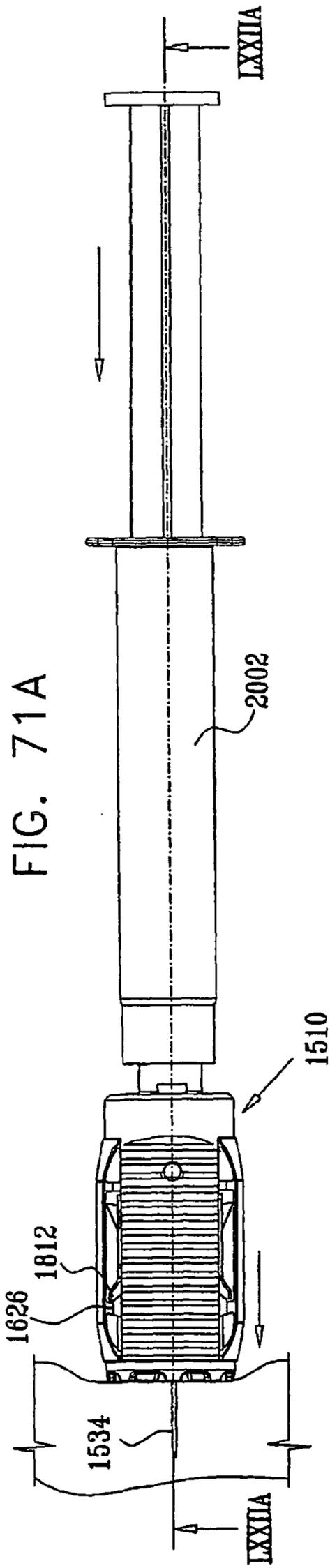
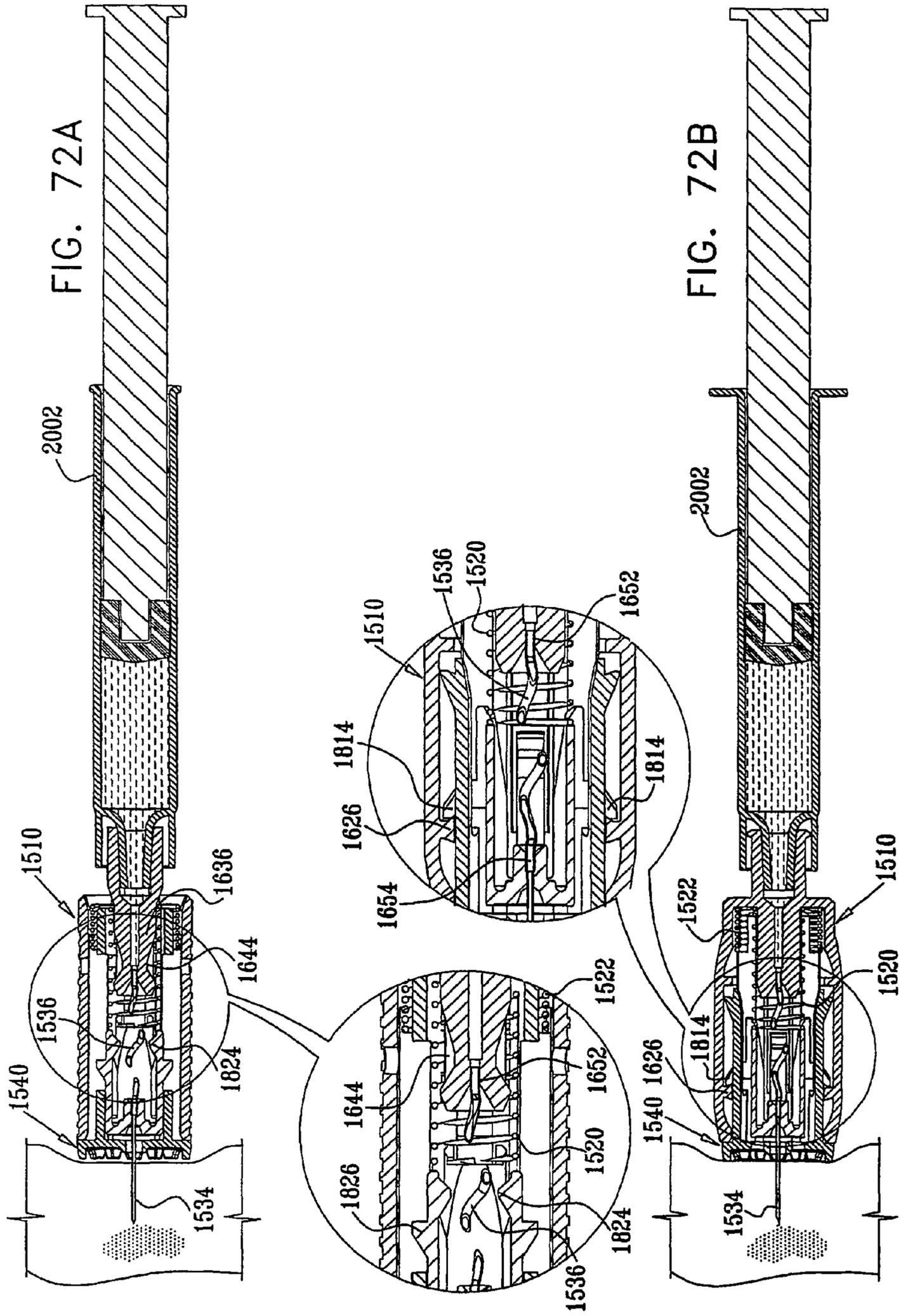


FIG. 70





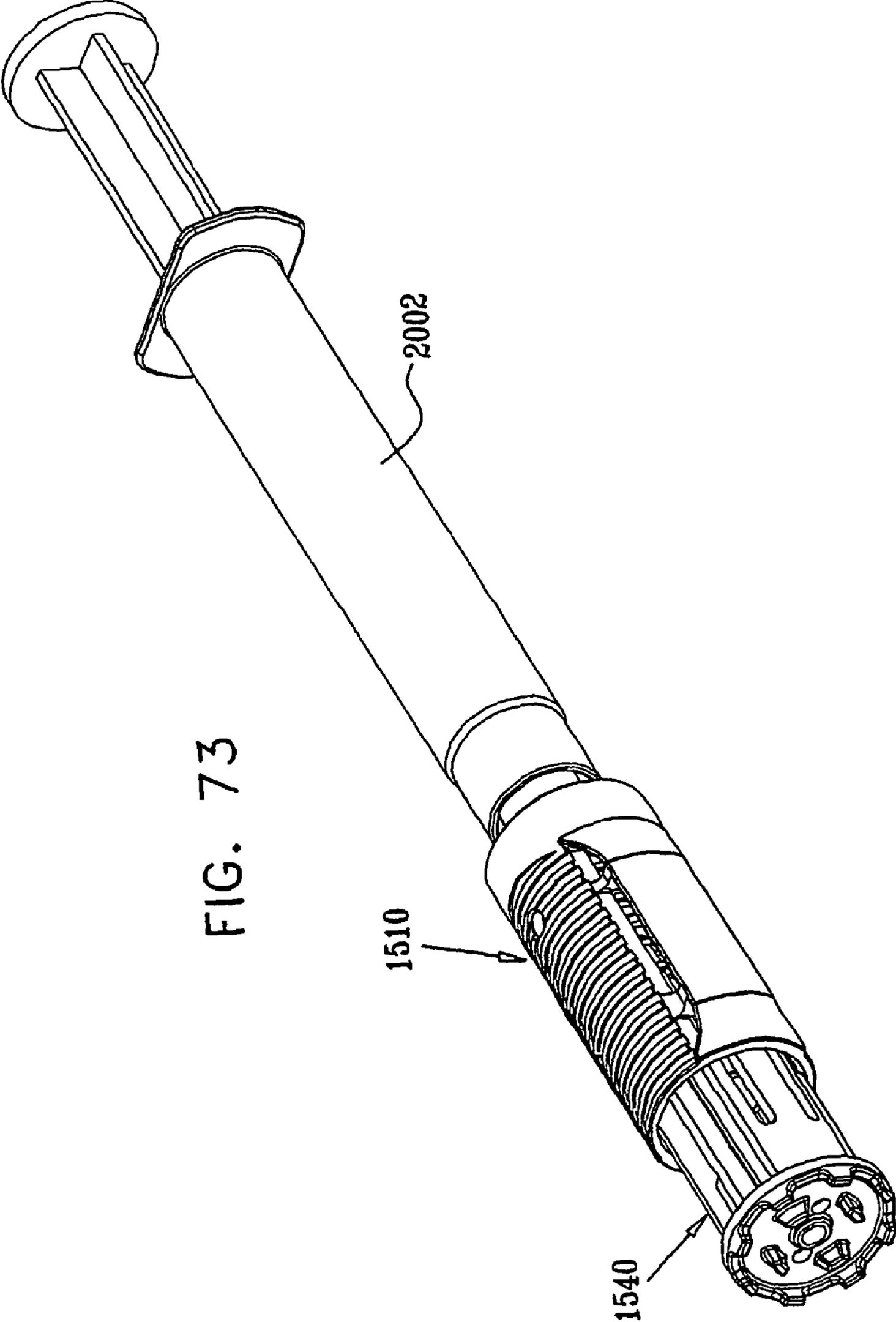
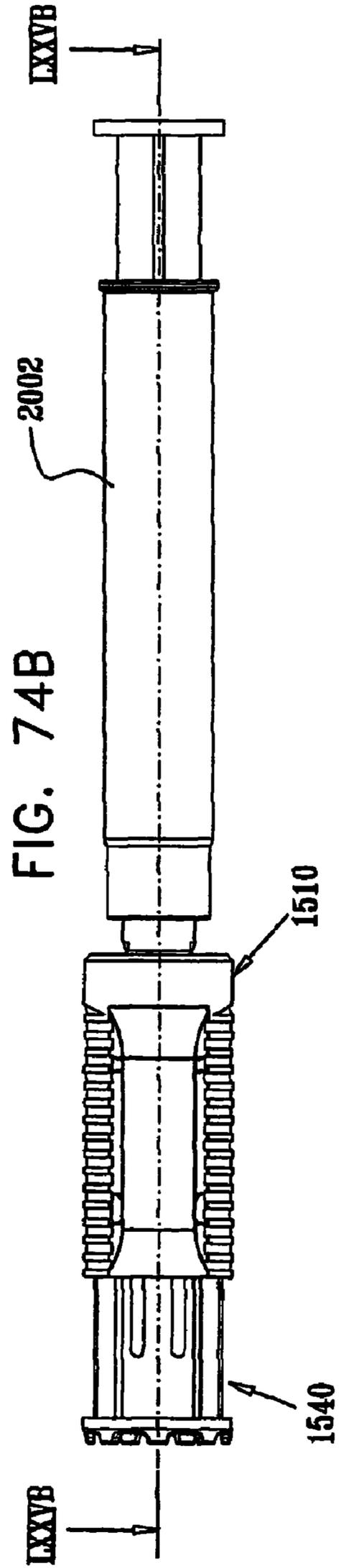
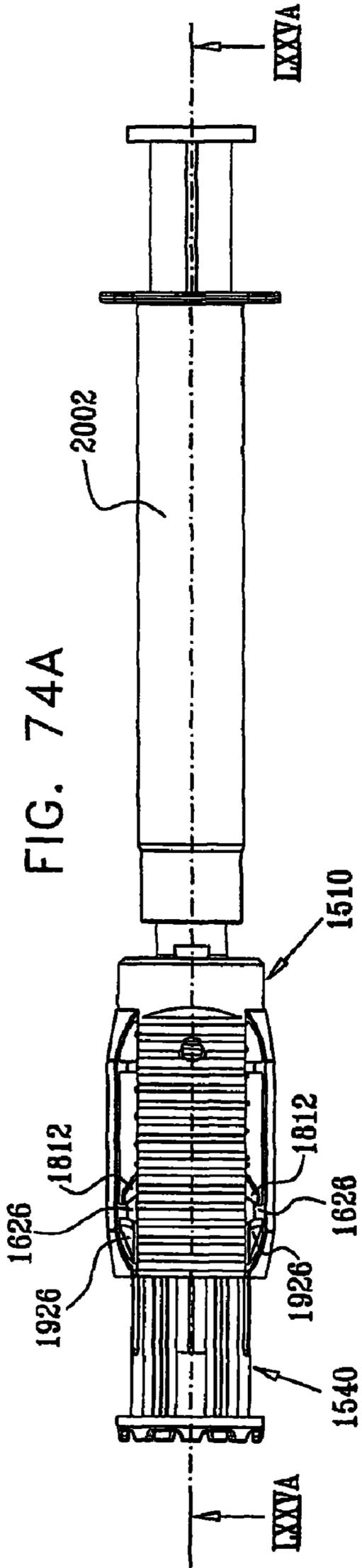
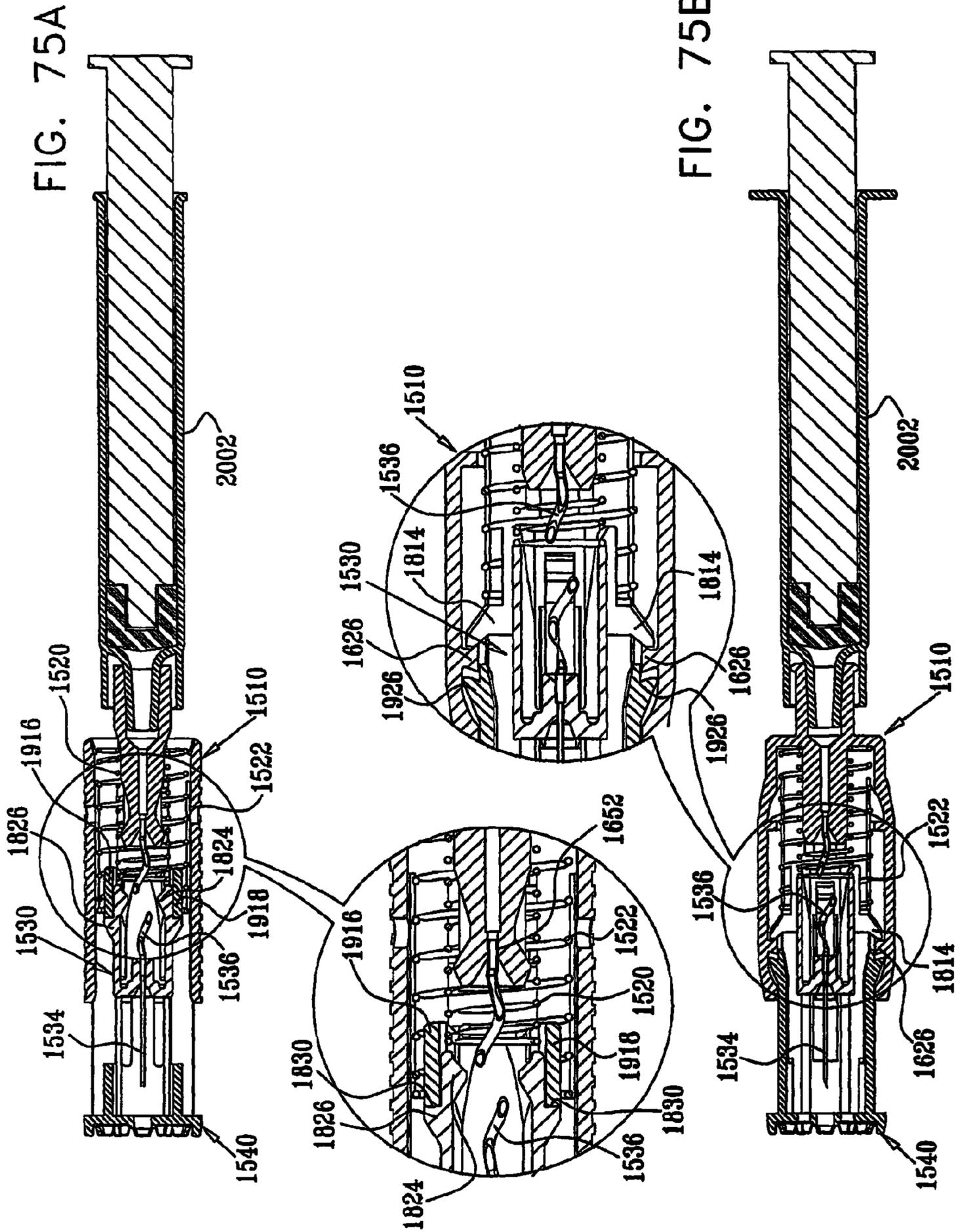


FIG. 73





## AUTOMATIC NEEDLE DEVICE

## CROSS-REFERENCE TO PRIOR APPLICATION

The above-referenced application is the U.S. National Phase of International Patent Application No. PCT/IL2004/000852, filed Sep. 15, 2004, which claims priority from Israeli Patent Application No. 157984, filed Sep. 17, 2003, all of which are incorporated herein. The International Application was published Mar. 24, 2005 as WO 2005/025637 A2 under PCT article 21(2).

## FIELD OF THE INVENTION

The present invention relates to automatic needle devices for hypodermic syringes generally.

## BACKGROUND OF THE INVENTION

The following U.S. Patents are believed to represent the current state of the art:

4,474,572; 4,475,906; 4,484,910; 4,487,602; 4,505,710; 4,512,767; 4,515,590; 4,518,387; 4,529,401; 4,529,403; 4,530,695; 4,534,759; 4,547,189; 4,553,962; 4,573,970; 4,573,976; 4,578,061; 4,578,064; 4,580,561; 4,592,744; 4,594,073; 4,596,558; 4,597,753; 4,600,403; 4,601,708; 4,613,328; 4,620,540; 4,620,847; 4,624,660; 4,650,468; 4,658,830; 4,659,326; 4,664,651; 4,664,654; 4,666,436; 4,672,967; 4,681,565; 4,687,465; 4,687,467; 4,689,042; 4,699,614; 4,710,170; 4,723,937; 4,735,618; 4,738,663; 4,743,234; 4,744,955; 4,745,907; 4,747,829; 4,747,831; 4,753,636; 4,755,169; 4,758,227; 4,758,230; 4,758,231; 4,766,908; 4,767,407; 4,767,413; 4,770,655; 4,781,683; 4,781,685; 4,781,688; 4,784,640; 4,787,384; 4,787,893; 4,790,823; 4,790,827; 4,795,432; 4,795,433; 4,798,587; 4,799,921; 4,804,370; 4,808,169; 4,813,937; 4,813,940; 4,820,275; 4,820,286; 4,826,484; 4,826,489; 4,826,490; 4,828,548; 4,832,682; 4,832,693; 4,834,704; 4,834,718; 4,842,598; 4,846,811; 4,850,961; 4,850,968; 4,850,971; 4,850,976; 4,850,977; 4,850,994; 4,861,338; 4,863,427; 4,863,435; 4,863,436; 4,865,592; 4,874,372; 4,874,382; 4,883,466; 4,883,472; 4,886,499; 4,887,998; 4,892,107; 4,892,523; 4,894,054; 4,894,055; 4,898,589; 4,900,303; 4,900,307; 4,900,311; 4,902,279; 4,904,242; 4,906,236; 4,908,022; 4,909,794; 4,909,795; 4,911,706; 4,913,702; 4,915,702; 4,917,672; 4,919,146; 4,919,657; 4,923,443; 4,923,445; 4,927,414; 4,929,237; 4,929,241; 4,931,040; 4,932,944; 4,932,946; 4,932,947; 4,935,013; 4,935,014; 4,936,830; 4,941,879; 4,944,723; 4,944,725; 4,946,441; 4,950,240; 4,950,241; 4,950,250; 4,950,252; 4,955,866; 4,955,868; 4,955,869; 4,955,870; 4,961,728; 4,966,589; 4,966,592; 4,966,593; 4,973,310; 4,973,317; 4,976,704; 4,988,335; 4,988,339; 4,994,045; 4,998,921; 4,998,922; 5,000,736; 5,000,737; 5,002,548; 5,007,903; 5,011,475; 5,015,240; 5,017,187; 5,019,043; 5,019,044; 5,019,047; 5,019,048; 5,021,059; 5,024,665; 5,026,349; 5,030,208; 5,034,003; 5,037,306; 5,037,382; 5,037,393; 5,037,400; 5,041,094; 5,042,977; 5,045,066; 5,047,016; 5,049,133; 5,049,136; 5,053,010; 5,053,018; 5,055,102; 5,057,086; 5,057,089; 5,059,180; 5,059,185; 5,061,249; 5,061,251; 5,064,419; 5,067,490; 5,067,948; 5,071,353; 5,080,104; 5,084,027; 5,084,029; 5,084,030; 5,085,640; 5,085,641; 5,085,642; 5,088,986; 5,088,988; 5,092,843; 5,092,851; 5,092,852; 5,092,853; 5,098,382; 5,098,400; 5,098,401; 5,102,393; 5,102,397; 5,104,378; 5,104,380; 5,104,384; 5,104,385; 5,106,370; 5,106,372; 5,106,379; 5,108,378; 5,108,379; 5,112,307; 5,112,316; 5,114,404; 5,120,310; 5,120,314; 5,120,321; 5,122,118; 5,122,124; 5,125,898; 5,125,899; 5,127,910; 5,135,507; 5,135,510; 5,137,515; 5,137,516; 5,141,496; 5,143,414; 5,147,311; 5,147,326; 5,147,327; 5,149,323; 5,152,751; 5,156,599; 5,160,326; 5,163,916; 5,163,917; 5,163,918; 5,167,632; 5,167,641; 5,169,389; 5,169,392; 5,176,641; 5,176,655; 5,176,656; 5,176,657; 5,183,468; 5,183,469; 5,188,614; 5,190,526; 5,193,552; 5,195,982; 5,195,983; 5,195,985; 5,199,952; 5,201,708; 5,201,710; 5,205,826; 5,205,827; 5,207,646; 5,207,699; 5,209,739; 5,211,628; 5,211,629; 5,215,524; 5,215,533; 5,215,534; 5,215,535; 5,215,536; 5,217,437; 5,219,338; 5,221,262; 5,222,943; 5,222,947; 5,222,974; 5,224,936; 5,226,882; 5,228,883; 5,232,457; 5,232,458; 5,238,654; 5,242,388; 5,242,401; 5,242,416; 5,242,420; 5,246,428; 5,250,031; 5,256,152; 5,257,976; 5,261,894; 5,263,933; 5,267,961; 5,267,963; 5,269,761; 5,269,762; 5,269,766; 5,273,532; 5,273,538; 5,273,539; 5,273,541; 5,273,544; 5,279,554; 5,279,566;

-continued

5,279,577; 5,279,579; 5,279,581; 5,279,582; 5,279,583; 5,279,590; 5,282,793; 5,282,822; 5,282,827; 5,284,479; 5,290,233; 5,290,239; 5,290,240; 5,290,254; 5,292,314; 5,295,963; 5,295,965; 5,295,972; 5,295,973; 5,295,974; 5,295,975; 5,300,029; 5,300,030; 5,300,040; 5,300,045; 5,304,137; 5,304,138; 5,306,251; 5,306,258; 5,308,332; 5,311,841; 5,312,353; 5,312,366; 5,312,368; 5,312,370; 5,312,371; 5,312,372; 5,314,503; 5,318,538; 5,320,609; 5,322,517; 5,324,265; 5,328,475; 5,328,482; 5,328,484; 5,330,430; 5,334,149; 5,334,158; 5,334,173; 5,336,180; 5,336,187; 5,336,199; 5,338,303; 5,338,311; 5,342,310; 5,342,320; 5,344,407; 5,344,408; 5,346,475; 5,346,480; 5,346,481; 5,348,544; 5,352,200; 5,352,202; 5,352,203; 5,354,287; 5,356,387; 5,358,489; 5,360,410; 5,364,362; 5,364,370; 5,366,447; 5,368,568; 5,368,570; 5,368,571; 5,370,619; 5,370,626; 5,374,250; 5,378,240; 5,383,857; 5,385,550; 5,385,551; 5,385,557; 5,389,076; 5,389,085; 5,391,151; 5,391,183; 5,395,317; 5,395,337; 5,399,163; 5,401,246; 5,401,249; 5,401,251; 5,403,286; 5,403,287; 5,405,326; 5,405,327; 5,407,436; 5,409,466; 5,411,487; 5,415,638; 5,415,645; 5,415,648; 5,419,766; 5,419,773; 5,423,746; 5,425,715; 5,425,722; 5,429,611; 5,429,612; 5,429,613; 5,431,631; 5,431,632; 5,433,712; 5,445,618; 5,445,620; 5,451,210; 5,458,576; 5,458,580; 5,460,611; 5,462,531; 5,466,223; 5,468,227; 5,474,687; 5,478,314; 5,478,316; 5,478,328; 5,480,385; 5,480,387; 5,480,390; 5,482,039; 5,484,414; 5,486,163; 5,486,164; 5,487,732; 5,487,733; 5,487,734; 5,489,272; 5,492,536; 5,496,278; 5,501,672; 5,512,048; 5,512,050; 5,514,097; 5,514,107; 5,520,639; 5,520,649; 5,522,797; 5,522,812; 5,527,283; 5,527,284; 5,527,307; 5,529,189; 5,531,691; 5,531,692; 5,531,694; 5,531,704; 5,531,706; 5,533,975; 5,533,984; 5,536,243; 5,536,253; 5,536,257; 5,538,506; 5,538,508; 5,540,664; 5,540,666; 5,542,920; 5,542,927; 5,549,558; 5,549,568; 5,549,570; 5,549,572; 5,549,708; 5,558,648; 5,562,623; 5,562,624; 5,562,626; 5,562,631; 5,569,202; 5,569,203; 5,573,513; 5,575,770; 5,578,011; 5,578,014; 5,578,015; 5,582,591; 5,586,976; 5,591,133; 5,591,134; 5,591,138; 5,593,387; 5,593,390; 5,599,309; 5,599,313; 5,599,316; 5,599,318; 5,601,532; 5,601,535; 5,605,544; 5,609,577; 5,611,781; 5,611,782; 5,613,500; 5,613,951; 5,613,952; 5,615,771; 5,616,123; 5,616,132; 5,616,134; 5,616,135; 5,620,422; 5,620,425; 5,624,401; 5,624,405; 5,628,765; 5,630,803; 5,632,730; 5,632,733; 5,634,906; 5,634,909; 5,634,937; 5,637,092; 5,637,094; 5,643,220; 5,643,222; 5,647,851; 5,649,622; 5,651,774; 5,653,687; 5,653,688; 5,653,693; 5,656,031; 5,658,256; 5,658,257; 5,658,258; 5,658,259; 5,662,610; 5,662,617; 5,665,071; 5,665,075; 5,669,889; 5,672,155; 5,672,161; 5,681,291; 5,681,295; 5,688,240; 5,688,251; 5,693,016; 5,693,022; 5,693,023; 5,695,472; 5,704,911; 5,704,921; 5,707,393; 5,709,662; 5,709,667; 5,709,668; 5,713,866; 5,713,871; 5,713,872; 5,720,727; 5,725,498; 5,738,655; 5,741,223; 5,743,879; 5,743,887; 5,743,888; 5,743,891; 5,746,718; 5,749,854; 5,749,860; 5,755,692; 5,769,822; 5,769,827; 5,779,675; 5,779,677; 5,779,684; 5,788,677; 5,788,713; 5,792,107; 5,792,121; 5,792,122; 5,795,336; 5,797,885; 5,800,403; 5,807,334; 5,807,345; 5,807,352; 5,810,775; 5,810,784; 5,817,054; 5,817,070; 5,820,602; 5,823,997; 5,823,998; 5,827,293; 5,830,130; 5,836,911; 5,836,920; 5,843,036; 5,843,047; 5,848,990; 5,851,197; 5,853,390; 5,853,393; 5,855,839; 5,858,000; 5,865,227; 5,865,804; 5,868,711; 5,879,337; 5,882,342; 5,885,257; 5,891,052; 5,891,092; 5,891,097; 5,891,105; 5,897,508; 5,899,885; 5,899,886; 5,908,404; 5,908,408; 5,910,131; 5,911,706; 5,919,166; 5,921,959; 5,921,960; 5,921,961; 5,921,963; 5,921,964; 5,925,019; 5,928,188; 5,928,194; 5,928,205; 5,931,813; 5,938,638; 5,938,639; 5,941,850; 5,944,692; 5,944,693; 5,951,522; 5,954,699; 5,957,892; 5,957,895; 5,957,897; 5,960,797; 5,961,491; 5,971,953; 5,976,111; 5,980,487; 5,980,488; 5,980,491; 5,980,494; 5,984,899; 5,984,900; 5,989,219; 5,989,221; 5,993,417; 5,993,418; 5,997,500; 5,997,511; 5,997,513; 6,001,080; 6,007,474; 6,010,486; 6,010,487; 6,015,396; 6,015,438; 6,017,325; 6,022,337; 6,033,386; 6,033,387; 6,036,674; 6,039,713; 6,050,974; 6,050,977; 6,056,716; 6,056,724; 6,056,734; 6,063,040; 6,063,053; 6,066,115; 6,068,616; 6,074,360; 6,074,369; 6,074,370; 6,077,245; 6,080,135; 6,083,199; 6,083,200; 6,086,562; 6,086,569; 6,090,077; 6,090,078; 6,090,080; 6,093,172; 6,099,500; 6,099,503; 6,099,504; 6,102,844; 6,113,574; 6,117,112; 6,117,113; 6,126,637; 6,129,710; 6,142,972; 6,149,626; 6,149,629; 6,156,008; 6,156,010; 6,156,013; 6,156,015; 6,159,161; 6,159,181; 6,159,185; 6,171,284; 6,179,812; 6,183,444; 6,183,446; 6,186,980; 6,192,891; 6,193,695; 6,206,856; 6,206,857; 6,210,369; 6,217,550; 6,217,559; 6,221,044; 6,221,051; 6,221,052; 6,224,576; 6,228,054; 6,228,055; 6,235,006; 6,241,707; 6,241,708; 6,254,575; 6,254,580; 6,258,056; 6,261,264; 6,261,265; 6,267,748; 6,270,472; 6,270,481; 6,273,870; 6,280,399; 6,280,420; 6,280,421; 6,283,941; 6,293,925; 6,299,601; 6,309,374; 6,309,375; 6,312,409; 6,315,113; 6,319,233; 6,319,234; 6,322,536; 6,325,781; 6,325,789; 6,331,173; 6,332,875; 6,344,031; 6,356,783; 6,361,525; 6,368,303; 6,371,938; 6,379,336; 6,387,078; 6,402,716; 6,409,701; 6,409,703; 6,409,706; 6,412,490; 6,413,236; 6,413,237; 6,416,323; 6,416,497; 6,419,658;

6,428,463; 6,428,517; 6,432,035; 6,432,082; 6,432,087; 6,436,068;  
 6,440,098; 6,443,929; 6,447,480; 6,454,743; 6,458,105; 6,461,331;  
 6,461,333; 6,468,247; 6,475,194; 6,478,780; 6,482,176; 6,485,469;  
 6,485,474; 6,494,863; 6,500,155; 6,508,755; 6,511,454; 6,514,230;  
 6,517,516; 6,517,517; 6,524,278; 6,527,734; 6,527,742; 6,530,896;  
 6,530,904; 6,537,249; 6,537,252; 6,544,234; 6,547,764; 6,551,275;  
 6,551,276; 6,551,278; 6,554,798; 6,558,351; 6,558,357; 6,565,533;  
 6,565,538; 6,569,115; 6,572,584; 6,572,585; 6,575,939; 6,579,256;  
 6,582,405; 6,584,910; 6,585,690; 6,585,693; 6,585,702; 6,589,158;  
 6,592,508; 6,592,555; 6,592,556; 6,595,962; 6,599,268; 6,599,269;  
 6,599,272; 6,605,058; 6,605,067; 6,605,073; 6,607,508; 6,607,509;  
 6,613,019; 6,613,022; 6,616,630; 6,616,638; 6,616,639; 6,620,136;  
 6,620,137; 6,620,138; 6,623,455; 6,623,458; 6,623,459; 6,626,864;  
 6,629,957; 6,629,959; 6,632,198; 6,637,587; 6,638,248; 6,638,255;  
 6,641,561; 6,645,181; 6,652,482; 6,656,164; 6,659,975; 6,659,982;  
 6,663,593; 6,669,666; 6,673,034; 6,673,044; 6,673,049; 6,678,550;  
 6,679,863; 6,679,864; 6,685,676; 6,685,677; 6,689,091; 6,689,106;  
 6,689,107; 6,689,108; 6,692,470; 6,692,471; 6,699,218; 6,702,784;  
 6,706,011; 6,706,015; 6,706,019; 6,709,416; 6,712,787; 6,712,788;  
 6,716,191; 6,716,197; 6,716,198; 6,719,721; 6,719,728; 6,719,730;  
 6,723,068; 6,723,072; 6,726,655; 6,726,658; 6,726,661; 6,726,662;  
 6,730,059; 6,736,800; 6,740,059; 6,743,203; 6,749,833; 6,752,782;  
 6,752,784; 6,752,798; 6,761,706; 6,767,336; RE 33,585; RE 34,335;  
 RE 34,936; RE 36,398; RE 36,447; RE 37,110; RE 37,252 and  
 RE 37,487.

## SUMMARY OF THE INVENTION

The present invention seeks to provide an improved automatic needle device. There is thus provided in accordance with a preferred embodiment of the present invention an automatic needle device including a housing element, at least one resilient element arranged to be located within the housing element, at least one needle bearing element adapted, when actuated, to be displaced by the at least one resilient element with respect to the housing element from a non-penetration position to a penetration position and a needle guard adapted for positioning with respect to the housing element and wherein displacement of the needle guard is operative to actuate displacement of the at least one needle bearing element from the non-penetration position to the penetration position.

Preferably, rearward displacement of the needle guard is operative to actuate displacement of the at least one needle bearing element from the non-penetration position to the penetration position.

Preferably, the automatic needle device also includes a safety element adapted to prevent inadvertent actuation of displacement of the at least one needle bearing element. Additionally, the safety element prevents inadvertent rearward displacement of the needle guard.

Preferably, of the present invention the at least one resilient element includes a unitary resilient element. Alternatively, the at least one resilient element includes first and second coil springs.

Preferably, the housing element includes an injection device engagement portion. Additionally, the housing element and the at least one needle bearing element together define a fluid pathway from the injection device engagement portion through the needle at least when the needle bearing element is in both the non-penetration position and the penetration position.

Preferably, the needle guard is displaceable by the at least one resilient element.

Preferably, the at least one resilient element includes first and second compression springs which provide selectable forward displacement to the at least one needle bearing element.

Preferably, the needle bearing element includes a hub portion and a needle adhered thereto and extending through a septum.

Preferably, the automatic needle device also includes a safety tab operative for disabling actuation of the automatic needle device. In accordance with yet another preferred embodiment of the present invention, the safety tab includes a spacer portion and a tab portion.

There is also provided in accordance with another preferred embodiment of the present invention an automatic needle device including a housing element, at least one needle bearing element adapted, when actuated, to be displaced with respect to the housing element from a non-penetration position to a penetration position and a needle guard adapted for positioning with respect to the at least one needle bearing element in a mutually locked needle guarding orientation, whereby displacement of the needle guard relative to the housing requires corresponding displacement of the at least one needle bearing element.

There is further provided in accordance with yet another preferred embodiment of the present invention an automatic needle device including a housing element, at least one needle bearing element adapted, when actuated, to be displaced with respect to the housing element from a non-penetration position to a penetration position and a needle guard adapted for positioning with respect to the at least one needle bearing element and with respect to the housing element in a mutually locked needle guarding orientation, whereby displacement of the needle guard in a first direction relative to the housing is prevented by engagement of the needle guard with the at least one needle bearing element and displacement of the needle guard in a second direction relative to the housing, opposite to the first direction, is prevented by engagement of the needle guard with the housing element.

There is even further provided in accordance with still another preferred embodiment of the present invention an automatic needle device including a housing element adapted to be connected to an external injection device, at least one needle bearing element adapted, when actuated, to be displaced with respect to the housing element from a non-penetration position to a penetration position and a needle guard adapted for positioning with respect to at least one of the at least one needle bearing element and the housing element in a needle guarding orientation.

There is still further provided in accordance with another preferred embodiment of the present invention an injection device including a housing element, a unitary resilient element arranged to be located within the housing element, the unitary resilient element including a septum portion and at least one displacement actuating portion, and at least one needle bearing element including a needle sealingly engaging the septum portion, the at least one needle bearing element adapted, when actuated, to be displaced by the at least one displacement actuating portion of the unitary resilient element with respect to the housing element from a non-penetration position to a penetration position.

Preferably, the housing element is an integrally formed element having a generally cylindrical configuration and is generally top-to-bottom and side-to-side symmetric about a longitudinal axis. Alternatively or additionally, the housing element includes a rearward generally tubular portion which terminates in an open back and defines forwardly thereof a generally cylindrical portion, whose outer configuration includes top and bottom grip regions. Additionally or alternatively, the housing element includes first and second forwardly and rearwardly tapered side protrusions.

5

Preferably, the automatic needle device also includes, at an inner surface of the generally cylindrical portion, forward and rearward inwardly extending transverse ribs and a plurality of inwardly extending longitudinal slots.

Preferably, the automatic needle device also includes, at an interior of the generally tubular portion, a generally cylindrical bore which communicates via a tapered interface with a forward bore, disposed interiorly of the cylindrical portion, the cylindrical bore being arranged to receive a septum.

Preferably, apertures are formed in cylindrical walls of the cylindrical bore in alignment along a line extending transversely to a longitudinal axis of the housing element.

Preferably, a forward-facing back wall surface of the generally cylindrical portion defines a seat for the at least one resilient element.

Preferably the housing element is formed with a pair of side-to-side symmetric windows, to allow viewing the tip of a needle held by the needle bearing element.

In accordance with another preferred embodiment of the present invention the needle bearing element includes a needle hub and a needle. Additionally, the needle bearing element has a generally cylindrical configuration and is top-to-bottom and side-to-side symmetric about a longitudinal axis. Additionally or alternatively, the needle bearing element defines a generally tubular body having formed thereon a pair of up-down mutually spaced, forwardly facing, outwardly extending hook protrusions. In accordance with another preferred embodiment of the present invention the protrusions are each associated with a rearward facing rib.

Preferably, a rearwardly extending arm is formed at both a top and a bottom of the tubular body, each arm including, adjacent an extreme rearwardly facing end thereof, a tapered inwardly facing tooth and forwardly thereof an outwardly facing tooth, having a transversely extending rearwardly facing surface.

Preferably top and bottom pairs of outwardly facing ribs are formed on the tubular portion, adjacent respective rearward facing ribs, the outwardly facing ribs being operative to slidably locate the needle bearing element within the needle guard.

Preferably, the tubular body defines a generally open back and a forward facing wall portion adjacent in which is formed a recess, which communicates with a narrow axial bore, arranged to receive the needle, which extends therethrough.

Preferably, a rearward facing external wall portion, located at a rearward end of the tubular body, defines a seat for the at least one resilient element.

In accordance with yet a further preferred embodiment of the present invention the needle guard has a generally cylindrical configuration and is top-to-bottom and side-to-side symmetric about a longitudinal axis. Additionally or alternatively, the needle guard defines a generally tubular body having formed thereon a plurality of circumferentially spaced, longitudinally extending, outward facing ribs, having rearward facing ends, the outward facing ribs being adapted to slidably locate the needle guard within inwardly extending longitudinal slots of the housing element.

Preferably, extending rearwardly of the outwardly facing ribs there is provided a curved rearward facing portion having a pair of inwardly facing ribs formed therein, and, extending rearwardly of the ribs, there is formed a symmetrically curved rearward facing portion having a pair of ribs formed therein. Additionally or alternatively, the curved rearward facing portions together with the rearward facing ends define a seat for a spring forming part of the at least one resilient element.

6

Preferably, the inwardly facing ribs are operative to slidably locate the needle bearing element within the needle guard, by allowing the outwardly facing ribs to slide therein.

Preferably, a rearwardly extending arm is formed at each side of the tubular body, each of the arms including adjacent an extreme rearwardly facing end thereof, an outwardly facing tooth, having an inclined forward surface and a transversely extending rearwardly facing surface. Additionally or alternatively, the tubular body defines a generally open back and a forward facing wall portion, defining an injection site engagement surface.

Preferably, the injection site engagement surface includes a pair of mutually concentric circles of mutually spaced forwardly extending protrusions and the forward facing wall portion is formed with an axial bore, arranged to allow a needle to extend therethrough.

Preferably, the needle guard is formed with a pair of side-to-side symmetric windows, to allow viewing of the tip of a needle.

Preferably, in a pre-use operative orientation suitable for storage, the housing element is joined to the needle bearing element by snap fit engagement of inner facing teeth formed on the needle bearing element into apertures formed in cylindrical walls of the housing element.

Preferably the at least one resilient element includes first and second compression springs, the first compression spring being maintained under compression between forward-facing back wall surface of a generally cylindrical portion of the housing element and a rearward facing wall portion of the needle bearing element and the second compression spring being maintained under compression between the forward facing back wall surface and rearward facing ends of the needle guard, which is slidably retained against disassembly forward movement by the positioning of curved rearward facing portions thereof immediately rearward of the inner facing teeth of the needle bearing element.

Preferably, the needle bearing element is retained in its place by engagement of rearwardly outwardly facing surfaces of the inner facing teeth with curved rearward facing portions of the needle guard, thus preventing rearwardly extending arms of the needle bearing element from bending outwardly and releasing the snap fit engagement of the inner facing teeth and apertures formed in the cylindrical walls of the cylindrical bore of the housing element. Additionally or alternatively, due to engagement of the needle guard with an injection site on a body, the needle guard is forced, against the urging of the at least one resilient element, to move axially in a rearward direction with respect to the remainder of the automatic needle device, thus sliding the curved rearward facing portions thereof further rearward of the outwardly facing teeth of the needle bearing element, thus allowing the arms of the needle bearing element to cantilever outwardly.

Preferably, at all times the needle sealingly and slidably engages a septum.

#### BRIEF DESCRIPTION OF THE DRAWINGS

The present invention will be understood and appreciated more fully from the following detailed description, taken in conjunction with the drawings in which:

FIG. 1 is a simplified exploded view illustration of an automatic needle device constructed and operative in accordance with a preferred embodiment of the present invention;

FIGS. 2A and 2B are simplified pictorial illustrations of a housing element which forms part of the automatic needle device of FIG. 1;

FIGS. 3A and 3B are respective top and side view simplified planar illustrations of the housing element of FIGS. 2A and 2B;

FIGS. 4A, 4B are sectional illustrations taken along respective section lines and directions IVA-IVA and IVB-IVB in FIGS. 3A and 3B;

FIGS. 5A and 5B are pictorial sectional illustrations taken along respective section lines and directions VA-VA and VB-VB in FIG. 2A;

FIGS. 6A and 6B are simplified pictorial illustrations of a needle hub assembly which forms part of the automatic needle device of FIG. 1;

FIGS. 7A and 7B are respective top and side view simplified planar illustrations of the needle hub assembly of FIGS. 6A and 6B;

FIGS. 8A and 8B are sectional illustrations taken along respective section lines and directions VIIIA-VIIIA and VIIIB-VIIIB in FIGS. 7A and 7B;

FIGS. 9A and 9B are pictorial sectional illustrations taken along respective section lines and directions IXA-IXA and IXB-IXB in FIG. 6A;

FIGS. 10A and 10B are simplified pictorial illustrations of a needle guard element which forms part of the automatic needle device of FIG. 1;

FIGS. 11A and 11B are respective top and side view simplified planar illustrations of the needle guard element of FIGS. 10A and 10B;

FIGS. 12A and 12B are sectional illustrations taken along respective section lines and directions XIIA-XIIA and XIIB-XIIB in FIGS. 11A and 11B;

FIGS. 13A and 13B are pictorial sectional illustrations taken along respective section lines and directions XIII A-XIII A and XIII B-XIII B in FIG. 10A;

FIGS. 14A, 14B, 14C and 14D are simplified pictorial illustration of typical use of the automatic needle device of FIG. 1;

FIGS. 15A and 15B are simplified assembled view illustrations of the automatic needle device of FIGS. 1 and 14A in a pre-use operative orientation;

FIGS. 16A and 16B are respective top and side view simplified planar illustrations of the automatic needle device of FIGS. 15A and 15B;

FIGS. 17A and 17B are sectional illustrations taken along respective section lines and directions XVII A-XVII A and XVII B-XVII B in FIGS. 16A and 16B;

FIG. 18 is a simplified pictorial illustration of the automatic needle device of FIGS. 1 and 14B in an injection site engagement operative orientation coupled to a syringe;

FIGS. 19A and 19B are respective top and side view simplified planar illustrations of the automatic needle device of FIG. 18 coupled to a syringe

FIGS. 20A and 20B are sectional illustrations taken along respective section lines and directions XX A-XX A and XX B-XX B in FIGS. 19A and 19B;

FIG. 21 is a simplified pictorial illustration of the automatic needle device of FIGS. 1 and 14C in a needle actuated operational orientation;

FIGS. 22A and 22B are respective top and side view simplified planar illustrations of the automatic needle device of FIG. 21;

FIGS. 23A and 23B are sectional illustrations taken along respective section lines and directions XXIII A-XXIII A and XXIII B-XXIII B in FIGS. 22A and 22B;

FIG. 24 is a simplified pictorial illustration of the automatic needle device of FIGS. 1 and 14D in a post-drug delivery, needle guarded operative orientation;

FIGS. 25A and 25B are respective top and side view simplified planar illustrations of the automatic needle device of FIG. 24;

FIGS. 26A and 26B are sectional illustrations taken along respective section lines and directions XXVI A-XXVI A and XXVI B-XXVI B in FIGS. 25A and 25B;

FIG. 27 is a simplified exploded view illustration of an automatic needle device constructed and operative in accordance with another preferred embodiment of the present invention;

FIGS. 28A and 28B are simplified pictorial illustrations of a housing element which forms part of the automatic needle device of FIG. 27;

FIGS. 29A and 29B are simplified pictorial sectional illustrations of the housing element of FIGS. 28A and 28B taken along lines XXIX A-XXIX A and XXIX B-XXIX B in FIG. 28A;

FIGS. 30A and 30B are respective top and side view simplified planar illustrations of the housing element of FIGS. 28A-29B;

FIGS. 31A, 31B and 31C are sectional illustrations taken along respective section lines and directions XXXI A-XXXI A, XXXI B-XXXI B and XXXI C-XXXI C in FIGS. 30A and 30B;

FIGS. 32A and 32B are simplified pictorial illustrations of a resilient element which forms part of the automatic needle device of FIG. 27;

FIGS. 33A and 33B are simplified pictorial sectional illustrations of the resilient element of FIGS. 32A and 32B taken along lines XXXIII A-XXXIII A and XXXIII B-XXXIII B in FIG. 32A;

FIGS. 34A and 34B are respective top and side view simplified planar illustrations of the resilient element of FIGS. 32A-33B;

FIGS. 35A and 35B are sectional illustrations taken along respective section lines and directions XXXV A-XXXV A and XXXV B-XXXV B in FIGS. 34A and 34B;

FIGS. 36A and 36B are simplified pictorial illustrations of a needle hub assembly which forms part of the automatic needle device of FIG. 27;

FIGS. 37A and 37B are simplified pictorial sectional illustrations of the needle hub assembly of FIGS. 36A and 36B taken along lines XXXVII A-XXXVII A and XXXVII B-XXXVII B in FIG. 36A;

FIGS. 38A and 38B are respective top and side view simplified planar illustrations of the needle hub assembly of FIGS. 36A-37B;

FIGS. 39A and 39B are sectional illustrations taken along respective section lines and directions XXXIX A-XXXIX A and XXXIX B-XXXIX B in FIGS. 38A and 38B;

FIGS. 40A and 40B are simplified pictorial illustrations of a needle guard element which forms part of the automatic needle device of FIG. 27;

FIGS. 41A and 41B are simplified pictorial sectional illustrations of the needle guard element of FIGS. 40A and 40B taken along the lines XL I A-XL I A and XL I B-XL I B in FIG. 40A;

FIGS. 42A and 42B are respective top and side view simplified planar illustrations of the needle guard element of FIGS. 40A-41B;

FIGS. 43A, 43B and 43C are sectional illustrations taken along respective section lines and directions XLIII A-XLIII A, XLIII B-XLIII B and XLIII C-XLIII C in FIGS. 42A and 42B;

FIGS. 44A, 44B, 44C, 44D, 44E and 44F are simplified pictorial illustrations of typical use of the automatic needle device of FIG. 27;

FIG. 45 is a simplified assembled view pictorial illustration of the automatic needle device of FIGS. 27 and 44A in a pre-use operative orientation, coupled to a syringe and prior to removal of a safety tab;

FIGS. 46A and 46B are respective top and side view simplified planar illustrations of the automatic needle device of FIG. 45;

FIGS. 47A and 47B are sectional illustrations taken along respective section lines and directions XLVIIA-XLVIIA and XLVIIIB-XLVIIIB in FIGS. 46A and 46B;

FIG. 47C is simplified illustration corresponding to FIG. 46A with the needle guard element hidden;

FIG. 47D is a partially cut-away illustration of the needle guard element and the needle hub assembly of FIG. 46B;

FIG. 48 is a simplified pictorial illustration of the automatic needle device of FIGS. 27 and 44B in an injection site engagement operative orientation following removal of the safety tab;

FIGS. 49A and 49B are respective top and side view simplified planar illustrations of the automatic needle device of FIG. 48;

FIGS. 50A and 50B are sectional illustrations taken along respective section lines and directions LA-LA and LB-LB in FIGS. 49A and 49B;

FIG. 50C is simplified illustration corresponding to FIG. 49A with the needle guard element hidden;

FIG. 50D is a partially cut-away illustration of the needle guard element and the needle hub assembly of FIG. 49B;

FIG. 51 is a simplified pictorial illustration of the automatic needle device of FIGS. 27 and 44C in a needle actuated operational orientation;

FIGS. 52A and 52B are respective top and side view simplified planar illustrations of the automatic needle device of FIG. 51;

FIGS. 53A and 53B are sectional illustrations taken along respective section lines and directions LIIIA-LIIIA and LIIIB-LIIIB in FIGS. 52A and 52B;

FIG. 53C is a simplified illustration of FIG. 52A with the needle guard element hidden;

FIG. 53D, is a partially cut-away illustration corresponding to the needle guard element and the needle hub assembly of FIG. 52B;

FIG. 54 is a simplified pictorial illustration of the automatic needle device of FIGS. 27 and 44D in an immediate post drug delivery operative orientation;

FIGS. 55A and 55B are respective top and side view simplified planar illustrations of the automatic needle device of FIG. 54;

FIGS. 56A and 56B are sectional illustrations taken along respective section lines and directions LVIA-LVIA and LVIB-LVIB in FIGS. 55A and 55B;

FIG. 56C is a simplified illustration corresponding to FIG. 55A with the needle guard element hidden;

FIG. 56D is a partially cut-away illustration of the needle guard element and the needle hub assembly of FIG. 55B;

FIG. 57 is a simplified pictorial illustration of the automatic needle device of FIGS. 27 and 44E in a post-drug delivery, needle guarded operative orientation;

FIGS. 58A and 58B are respective top and side view simplified planar illustrations of the automatic needle device of FIG. 57;

FIGS. 59A and 59B are sectional illustrations taken along respective section lines and directions LIXA-LIXA and LIXB-LIXB in FIGS. 58A and 58B;

FIG. 59C is a simplified illustration corresponding to FIG. 58A with the needle guard element hidden;

FIG. 59D is a partially cut-away illustration of the needle guard element and the needle hub assembly of FIG. 58B;

FIG. 60 is a simplified pictorial illustration of the automatic needle device of FIGS. 27 and 44F in a needle guard pushed back misuse operative orientation;

FIGS. 61A and 61B are respective top and side view simplified planar illustrations of the automatic needle device of FIG. 60;

FIGS. 62A and 62B are sectional illustrations taken along respective section lines and directions LXIIA-LXIIA and LXIIB-LXIIB in FIGS. 61A and 61B;

FIG. 62C is simplified illustration corresponding to FIG. 61A with the needle guard element hidden;

FIG. 62D is a partially cut-away of the needle guard element and the needle hub assembly of FIG. 61B;

FIG. 63 is a simplified exploded view illustration of an automatic needle device constructed and operative in accordance with yet another preferred embodiment of the present invention, which is a modified version of the embodiment of FIGS. 1-26;

FIGS. 64A and 64B are simplified assembled view illustrations of the automatic needle device of FIG. 63 in a pre-use operative orientation;

FIGS. 65A and 65B are respective top and side view simplified planar illustrations of the automatic needle device of FIGS. 64A and 64B;

FIGS. 66A and 66B are sectional illustrations taken along respective section lines and directions LXVIA-LXVIA and LXVIB-LXVIB in FIGS. 65A and 65B;

FIG. 67 is a simplified pictorial illustration of the automatic needle device of FIG. 63 in an injection site engagement operative orientation coupled to a syringe;

FIGS. 68A and 68B are respective top and side view simplified planar illustrations of the automatic needle device of FIG. 67 coupled to a syringe

FIGS. 69A and 69B are sectional illustrations taken along respective section lines and directions LXIXA-LXIXA and LXIXB-LXIXB in FIGS. 68A and 68B;

FIG. 70 is a simplified pictorial illustration of the automatic needle device of FIG. 63 in a needle actuated operational orientation;

FIGS. 71A and 71B are respective top and side view simplified planar illustrations of the automatic needle device of FIG. 70;

FIGS. 72A and 72B are sectional illustrations taken along respective section lines and directions LXXIIA-LXXIIA and LXXIIB-LXXIIB in FIGS. 71A and 71B;

FIG. 73 is a simplified pictorial illustration of the automatic needle device of FIG. 63 in a post-drug delivery, needle guarded operative orientation;

FIGS. 74A and 74B are respective top and side view simplified planar illustrations of the automatic needle device of FIG. 73; and

FIGS. 75A and 75B are sectional illustrations taken along respective section lines and directions LXXVA-LXXVA and LXXVB-LXXVB in FIGS. 74A and 74B.

#### DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

Reference is now made to FIGS. 1-13B, which illustrate the constituent elements of an automatic needle device constructed and operative in accordance with a preferred embodiment of the present invention.

As seen with particular clarity in FIG. 1, the automatic needle device comprises a housing element 10 into which are generally coaxially seated respective first and second com-

## 11

pression springs **20** and **22**, which provide selectable forward displacement to a needle hub assembly **30**, which includes a hub portion **32** and a needle **34** adhesively adhered thereto and extending rearwardly through a septum **36**, and to a needle guard element **40**. Alternatively, needle hub portion **32** may be injected onto the needle, by a method such as insert molding.

A safety tab **60** including a tubular portion **62** and a tab portion **64** is preferably mounted onto the forward section of housing element **10**, thus disabling actuation of the automatic needle device. The automatic needle device is only functional once the safety tab is removed, as described hereinbelow.

It will be appreciated by persons skilled in the art that safety tab **60** can be formed of any suitable material, for example such as polypropylene, and may be designed in many different shapes, such as a portion which is inserted into a slot between the needle guard element **40** and the housing element **10**, as a stand alone injection molded part, or as an integral part of any suitable part of the automatic needle device such as the housing element **10** as described e.g. hereinbelow with reference to FIGS. **27-62D**, the needle guard element **40** or the needle hub **32**.

It will additionally be appreciated by those skilled in the art that compression springs **20** and **22** may be replaced with a resilient element as described hereinbelow with reference to FIGS. **27-62D**. Alternatively, compression springs **20** and **22** may be replaced by tension springs, elastomeric compression springs or plastic springs which may be integrated into housing element **10**, into needle hub portion **32** or into needle guard element **40**.

Reference is now made to FIGS. **2A** and **2B**, which are simplified pictorial illustrations of a preferred housing element **10** which forms part of the automatic needle device of FIG. **1**, to FIGS. **3A** and **3B** are respective top and side view simplified planar illustrations thereof to FIGS. **4A** and **4B** which are sectional illustrations taken along respective section lines and directions **IVA-IVA** and **IVB-IVB** in FIGS. **3A** and **3B** and to FIGS. **5A** and **5B** which are pictorial sectional illustrations taken along respective section lines and directions **VA-VA** and **VB-VB** in FIG. **2A**.

As seen in FIGS. **2A-5B**, the housing element **10** preferably is an integrally formed element, preferably injection molded of plastic. Housing element **10** preferably has a generally cylindrical configuration and is preferably top-to-bottom and side-to-side symmetric about a longitudinal axis **100**.

Housing element **10** preferably includes a rearward generally tubular portion **110**, which terminates in an open back and defines generally symmetric side-facing tabs **114**. Forward of rearward generally tubular portion **110** there is provided a generally cylindrical portion **118**, whose outer configuration preferably includes top and bottom grip regions **120**, which are ribbed in a direction transverse to longitudinal axis **100** and first and second forwardly and rearwardly tapered side protrusions **122**.

At an inner surface of generally cylindrical portion **118** there are provided forward and rearward inwardly extending transverse ribs **126** and **128** and a plurality of inwardly extending longitudinal slots **130**. The interior of tubular portion **110** defines a generally cylindrical bore **134**. Bore **134** communicates via a tapered interface with a forward bore **136**, disposed interiorly of cylindrical portion **118**, which is arranged to receive septum **36**. Bore **136** has a circular cross section which is slightly smaller than that of bore **134**.

Apertures **144** are formed in the cylindrical walls of bore **136** in alignment along a line extending transversely to lon-

## 12

gitudinal axis **100**. A forward-facing back wall surface **154** of generally cylindrical portion **118** defines a spring seat for springs **20** and **22**.

The housing element **10** may optionally be formed with a pair of side-to-side symmetric windows, to allow viewing of the tip of the needle **34**, for example, when purging air bubbles from syringe **50**. Alternatively, housing element **10** may be formed of a transparent material.

Reference is now made to FIGS. **6A** and **6B**, which are simplified pictorial illustrations of a needle hub assembly **30** which forms part of the automatic needle device of FIG. **1**, to FIGS. **7A** and **7B**, which are respective top and side view simplified planar illustrations of the needle hub assembly of FIGS. **6A** and **6B**, to FIGS. **8A** and **8B**, which are sectional illustrations taken along respective section lines and directions **VIIIA-VIIIA** and **VIIIB-VIIIB** in FIGS. **7A** and **7B** and to FIGS. **9A** and **9B**, which are pictorial sectional illustrations taken along respective section lines and directions **IXA-IXA** and **IXB-IXB** in FIG. **6A**.

As seen in FIGS. **6A-9B**, the needle hub assembly **30** preferably comprises a needle hub **32**, which is an integrally formed element, preferably injection molded of plastic, and a needle **34**. Needle hub assembly **30** preferably has a generally cylindrical configuration and is preferably top-to-bottom and side-to-side symmetric about a longitudinal axis **300**, which, when assembled together with housing element **10**, is coaxial with longitudinal axis **100** (FIGS. **2A-5B**).

Needle hub assembly **30** preferably defines a generally tubular body **310**. A pair of up-down mutually spaced, forwardly facing, outwardly extending hook protrusions **312** and **314** is formed on each side of tubular portion **310**. Protrusions **312** and **314** are each associated with a rearward facing rib, here designated **316** and **318** respectively.

A rearwardly extending arm **320** is formed at both the top and the bottom of tubular body **310**. Each arm includes, adjacent an extreme rearwardly facing end **322** thereof, a tapered inwardly facing tooth **324** and forwardly thereof an outwardly facing tooth **326**, having a transversely extending rearwardly facing surface **330**.

Top and bottom pairs of outwardly facing ribs **332** and **334** are preferably formed on tubular portion **310**, adjacent rearward facing ribs **316** and **318** respectively. Outwardly facing ribs **332** and **334** are operative to slidably locate needle hub assembly **30** within needle guard element **40**. Tubular body **310** defines a generally open back and a forward facing wall portion **340** adjacent in which is formed a recess **342**, which communicates with a narrow axial bore **344**, arranged to receive needle **34**, which extends therethrough and is held in place, preferably by an adhesive, which is located in recess **342**. A rearward facing external wall portion **350**, located at the rearward end of tubular body **310**, defines a spring seat for spring **20**, which is partially surrounded by rearward facing ends of ribs **316** and **318**.

Reference is now made to FIGS. **10A** and **10B**, which are simplified pictorial illustrations of a needle guard element **40** which forms part of the automatic needle device of FIG. **1**, to FIGS. **11A** and **11B**, which are respective top and side view simplified planar illustrations of the needle guard element of FIGS. **10A** and **10B**, to FIGS. **12A** and **12B**, which are sectional illustrations taken along respective section lines and directions **XIIA-XIIA** and **XIIB-XIIB** in FIGS. **11A** and **11B** and to FIGS. **13A** and **13B** which are pictorial sectional illustrations taken along respective section lines and directions **XIIIA-XIIIA** and **XIIIB-XIIIB** in FIG. **10A**.

As seen in FIGS. **10A-13B**, the needle guard element **40** preferably is an integrally formed element, preferably injection molded of plastic. Needle guard **40** preferably has a

generally cylindrical configuration and is preferably top-to-bottom and side-to-side symmetric about a longitudinal axis **400**, which, when assembled together with housing element **10** and needle hub assembly **30** is coaxial with longitudinal axis **100** (FIGS. 2A-5B) and longitudinal axis **300** (FIGS. 6A-9B).

Needle guard element **40** preferably defines a generally tubular body **410**. Four mutually circumferentially spaced, longitudinally extending, outward facing ribs **412** and **414**, having rearward facing ends **413** and **415** respectively, are formed on both the top and the bottom of generally tubular body **410**. Outward facing ribs **412** and **414** are adapted to slidably locate the needle guard element **40** within the inwardly extending longitudinal slots **130** of the housing element **10**. Extending rearwardly of ribs **412** is a curved rearward facing portion **416** having a pair of ribs **417** formed therein, and extending rearwardly of ribs **414** is a similar and symmetrically curved rearward facing portion **418** having a pair of ribs **419** formed therein.

Curved rearward facing portions **416** and **418** together with rearward facing ends **413** and **415** define the seat for spring **22**. Ribs **417** and **419** are operative to slidably locate needle hub assembly **30** within needle guard element **40**, by allowing outwardly facing ribs **332** and **334** to slide therein. A rearwardly extending arm **420** is formed at each side of tubular body **410**. Each arm includes adjacent an extreme rearwardly facing end **422** thereof, an outwardly facing tooth **426**, having an inclined forward surface **428** and a transversely extending rearwardly facing surface **430**.

Tubular body **410** defines a generally open back and a forward facing wall portion **440**, defining an injection site engagement surface characterized in that it has a pair of mutually concentric circles **442** and **444** of mutually spaced forwardly extending protrusions **446**. Forward facing wall portion **440** is formed with an axial bore **450**, arranged to allow needle **34** to extend therethrough.

Top and bottom windows **452** and **454** are defined between respective pairs of ribs **412** and **414**.

The needle guard element **40** may optionally be formed with a pair of side-to-side symmetric windows, to allow viewing of the tip of the needle **34**, for example when purging air bubbles from syringe **50**. Alternatively, needle guard element **40** may be formed of a transparent material.

Reference is now made to FIGS. **14A**, **14B**, **14C** and **14D** which when taken together form a simplified pictorial illustration of various stages of typical use of the automatic needle device of FIG. **1**. As seen in FIG. **14A** the automatic needle device of FIG. **1** is stored prior to use in a pre-use operative orientation, described hereinbelow with reference to FIGS. **15-17B**. When ready for use, the user attaches a syringe **502**, containing a drug and ready for injection, to the automatic needle device of FIG. **1**, by inserting a forward end **504** of the syringe **502** into generally tubular portion **110** of housing element **10**.

As shown in FIG. **14B**, the user may then pull on tab portion **64** of safety tab **60** (FIG. **1**), thereby disengaging the tubular portion **62** from the automatic needle device and allowing activation of the automatic needle device.

The user may subsequently actuate the automatic needle device by pushing it against an injection site as indicated in FIG. **14B** and as described hereinbelow with reference to FIGS. **18-20B**. In response to user actuation, automatic needle penetration takes place at the injection site, as indicated in FIG. **14C**. Immediately thereafter drug delivery takes place, by user depression of a plunger in syringe **502**. The

operative orientation of the automatic needle device at this stage is described hereinbelow with reference to FIGS. **21-23B**.

The operative orientation of the automatic needle device immediately following completion of drug delivery and disengagement of the automatic needle from the injection site is indicated in FIG. **14D** and is described hereinbelow with reference to FIGS. **24-26B**.

Reference is now made to FIGS. **15A** and **15B**, which are simplified assembled view illustrations of the automatic needle device of FIGS. **1** and **14A** in a pre-use operative orientation, to FIGS. **16A** and **16B**, which are respective top and side view simplified planar illustrations thereof and to FIGS. **17A** and **17B**, which are sectional illustrations taken along respective section lines and directions XVIIA-XVIIA and XVIIIB-XVIIIB in FIGS. **16A** and **16B**.

As seen in FIGS. **15-17B**, in a pre-use operative orientation of the automatic needle device, suitable for storage, the housing element **10** is joined to the needle hub assembly **30** by engagement of inner facing teeth **324** into apertures **144** formed in the cylindrical walls of bore **136**. First and second compression springs **20** and **22** are located mutually coaxially within housing element **10**.

Compression spring **20** is maintained under compression between forward-facing back wall surface **155** of generally cylindrical portion **118** of housing element **10** and rearward facing wall portion **350** of hub assembly **30**.

Compression spring **22** is maintained under compression between forward facing back wall surface **154** and rearward facing ends **413** and **415** of needle guard element **40**, which is slidably retained against forward movement by the positioning of curved rearward facing portions **416** and **418** thereof immediately rearward of teeth **326** of needle hub assembly **30**.

The needle hub assembly **30** is retained in place by engagement of outwardly facing surfaces of inner facing teeth **324** of rearwardly extending arms **320** and curved rearward facing portions **416** and **418** of needle guard element **40**. This prevents rearwardly extending arms **320** of needle hub assembly **30** from bending outwardly and releasing the engagement of inner facing teeth **324** and apertures **144** formed in the cylindrical walls of bore **136** of the housing **10**. The tubular portion **62** of safety tab **60** prevents the needle guard element **40** from moving backwards and allowing needle penetration.

Reference is now made to FIG. **18**, which is a simplified pictorial illustration of the automatic needle device of FIGS. **1** and **14B** after coupling to a syringe **502** in an injection site engagement operative orientation, to FIGS. **19A** and **19B**, which are respective top and side view simplified planar illustrations thereof and to FIGS. **20A** and **20B**, which are sectional illustrations taken along respective section lines and directions XXA-XXA and XXB-XXB in FIGS. **19A** and **19B**.

As seen particularly in FIG. **20A**, due to engagement of the needle guard element **40** with an injection site on a body, the needle guard **40** is forced, against the urging of spring **22**, to move axially in a rearward direction with respect to the remainder of the automatic needle device, thus sliding curved rearward facing portions **416** and **418** thereof further rearward of teeth **326** of needle hub assembly **30**.

This rearward repositioning of curved rearward facing portions **416** and **418** and the pressure of spring **20**, allow arms **320** of needle hub assembly **30** to cantilever outwardly.

Reference is now made to FIG. **21**, which is a simplified pictorial illustration of the automatic needle device of FIGS. **1** and **14C** in an actuated operative orientation, to FIGS. **22A** and **22B** which are respective top and side view simplified

planar illustrations thereof and to FIGS. 23A and 23B which are sectional illustrations taken along respective section lines and directions XXIIIA-XXIIIA and XXIIIB-XXIIIB in FIGS. 22A and 22B.

As seen particularly in FIG. 23A, under the urging of spring 20, inner facing teeth 324 slide out of apertures 144 formed in the cylindrical walls of bore 136, thus allowing the needle hub assembly 30 to move axially forward and to provide needle penetration. The forward motion of needle hub assembly 30 stops when protrusions 312 and 314 come into touching engagement with inwardly extending transverse ribs 126 of the housing 10. At this stage, drug delivery may take place in response to manual operation of syringe 502

It is appreciated that at all times needle 34 sealingly and slidably engages septum 36.

Reference is now made to FIG. 24, which is a simplified pictorial illustration of the automatic needle device of FIGS. 1 and 14D in a post-drug delivery, needle guarded operative orientation, to FIGS. 25A and 25B, which are respective top and side view simplified planar illustrations thereof and to FIGS. 26A and 26B, which are sectional illustrations taken along respective section lines and directions XXVIA-XXVIA and XXVIB-XXVIB in FIGS. 25A and 25B.

FIGS. 24-26B illustrate the automatic needle device fully disengaged from the injection site and the needle guard 40 is fully extended under the urging of spring 22 to fully enclose the needle 34. The needle guard 40 is prevented from moving farther forwards by engagement of curved rearward facing portions 416 and 418 and rearwardly extending surface 330 of teeth 326 of needle hub assembly 30. The needle hub assembly 30 is prevented from moving further forward by protrusions 312 and 314 leaning against inwardly extending transverse ribs 126 of the housing 10. The needle guard 40 is prevented from moving rearwardly by outwardly facing tooth 426, which fits in front of inwardly extending transverse ribs 126 of the housing 10. Therefore, at this stage the needle guard 40 is locked in place, protecting keeping the needle 34 from inadvertent engagement.

It is appreciated that the automatic needle device can be attached to various types of injection devices, and that the a luer adapter defined by an internal tapered surface of the tubular portion 110 of the housing element 10 of the automatic needle device may be readily modified for engagement with various injection devices such as pen injectors. It is also possible to integrate the automatic needle apparatus described herein into another injection device and thus to eliminate the need for a luer adapter.

Reference is now made to FIGS. 27-43C, which illustrate the constituent elements of an automatic needle device constructed and operative in accordance with another preferred embodiment of the present invention.

As seen with particular clarity in FIG. 27, the automatic needle device comprises a housing element 810, having an integrally formed safety tab 812, including a tab portion 814 and a spacer portion 816, a resilient element 820, which provides selectable forward displacement to a needle hub assembly 830, which includes a hub portion 832 and a needle 834 adhesively or otherwise adhered thereto and extending rearwardly through a septum portion of resilient element 820, and to a needle guard element 840.

It is appreciated that safety tab 812 can be a separate part formed of any suitable material, for example such as polypropylene, and may formed in various configurations, such as a portion which is inserted into a slot between the needle guard element 840 and the housing element 810, as a stand alone injection molded part, or as an integral part of any of the parts

of the automatic needle device such as the housing element 810, the needle guard element 840 or the needle hub 832.

It will additionally be appreciated by those skilled in the art that resilient element 820 may be replaced with compression springs as described hereinabove with reference to FIGS. 1-26B. Alternatively, compression springs 20 and 22 may be replaced by tension springs, elastomeric compression springs or plastic springs which are preferably integrated into housing element 810, into needle hub assembly 830 or into needle guard element 840.

Reference is now made to FIGS. 28A and 28B, which are simplified pictorial illustrations of a preferred housing element 810 which forms part of the automatic needle device of FIG. 27, to FIGS. 29A and 29B which are simplified pictorial sectional illustrations of the housing element of FIGS. 28A and 28B taken along lines XXIXA-XXIXA and XXIXB-XXIXB in FIG. 28A, to FIGS. 30A and 30B which are respective top and side view simplified planar illustrations thereof and to FIGS. 31A, 31B and 31C which are sectional illustrations taken along respective section lines and directions XXXIA-XXXIA, XXXIB-XXXIB and XXXIC-XXXIC in FIGS. 30A and 30B.

As seen in FIGS. 28A-31C, the housing element 810 preferably is an integrally formed element, preferably injection molded of plastic. Housing element 810 preferably has a generally cylindrical configuration and is preferably side-to-side symmetric about a longitudinal axis 900.

Housing element 810 preferably includes a rearward generally tubular portion 910, which terminates in an open back and defines generally symmetric side-facing tabs 914. Forward of rearward generally tubular portion 910 there is provided a flange 916 onto which is removably mounted safety tab 812 (FIG. 27) which, as will be described hereinbelow, when intact, prevents the needle guard 840 from rearward displacement into engagement with flange 916.

Forward of flange 916 there are provided a pair of side-to-side symmetric generally axially directed, radially extending ribs 920, each of which is formed with a rearward facing shoulder 926. Also extending forwardly of flange 916 there is provided a generally axially directed rib 930, which includes a narrow, generally axially directed, radially extending portion 932 forward of which a generally planar portion 934 is formed generally perpendicular to an underlying generally radially extending portion 936. The generally planar portion 934 includes a radially inwardly tapered rearward facing surface 938 and a generally radial forward facing surface 940.

Forwardly of surface 940, rib 930 includes a further narrow not fully axially directed, radially extending portion 942 followed by a generally axially directed, radially extending portion 944, having a rearward facing surface 946. A socket 948 is formed between forward facing surface 940 of planar portion 934 and rearward facing surface 946 of portion 944.

Interiorly of ribs 920 and 930 there is provided a forwardly tapered passageway 950 which terminates in a generally circular septum receiving socket 954 having a plurality of circumferentially distributed apertures 956.

Reference is now made to FIGS. 32A and 32B, which are simplified pictorial illustrations of a resilient element which forms part of the automatic needle device of FIG. 27, to FIGS. 33A and 33B which are simplified pictorial sectional illustrations of the resilient element of FIGS. 32A and 32B taken along lines XXXIIIA-XXXIIIA and XXXIIIB-XXXIIIB in FIG. 32A, to FIGS. 34A and 34B which are respective top and side view simplified planar illustrations of the resilient element of FIGS. 32A-33B and to FIGS. 35A and 35B which are

sectional illustrations taken along respective section lines and directions XXXVA-XXXVA and XXXVB-XXXVB in FIGS. 34A and 34B.

As seen in FIGS. 32A-35B, the resilient element 820 is an integrally formed element, preferably injection molded or compression molded of rubber or plastic and preferably has a generally cylindrical configuration and is preferably top-to-bottom and side-to-side symmetric about a longitudinal axis 1000, which, when assembled together with housing element 810, is coaxial with longitudinal axis 900 (FIGS. 28A-31C).

The resilient element preferably includes a generally cylindrical central portion 1010, having a rear-facing wall 1012 formed with a tapered peripheral edge 1014 followed by a peripheral protrusion 1016 having a rounded cross section. Forward of protrusion 1016 is a generally cylindrical portion 1018 having four, circumferentially distributed, radially extending teeth 1020, each of which has a forwardly radially outwardly inclined surface 1022 terminating in a forward facing surface 1024 which lies in a plane which is generally perpendicular to longitudinal axis 1000.

Forward of cylindrical portion 1018 is a forward facing flange 1030 having radially outward extending protrusions 1032 at four corners thereof, separated from each other by 90 degrees. Extending rearwardly and radially outwardly from each protrusion 1032 are tensioned arms 1033, 1034, 1035 and 1036, each of which terminates in a generally rectangular end portion 1037 having tapered outer edges 1038 and formed with a generally rectangular aperture 1040. Tensioned arms 1033 and 1034 are slightly shorter than tensioned arms 1035 and 1036.

Reference is now made to FIGS. 36A and 36B, which are simplified pictorial illustrations of a needle hub assembly which forms part of the automatic needle device of FIG. 27, to FIGS. 37A and 37B which are simplified pictorial sectional illustrations of the needle hub assembly of FIGS. 36A and 36B taken along lines XXXVIIA-XXXVIIA and XXXVIIB-XXXVIIB in FIG. 36A, to FIGS. 38A and 38B which are respective top and side view simplified planar illustrations of the needle hub assembly of FIGS. 36A-37B and to FIGS. 39A and 39B are sectional illustrations taken along respective section lines and directions XXXIXA-XXXIXA and XXXIXB-XXXIXB in FIGS. 38A and 38B.

As seen in FIGS. 36A-39B, the needle hub assembly 830 preferably comprises a needle hub 832 which is an integrally formed element, preferably injection molded of plastic and a needle 834. Needle hub assembly 830 preferably has a generally cylindrical configuration and is preferably top-to-bottom and side-to-side mirror image symmetric about a longitudinal axis 1100, which, when assembled together with housing element 810, is coaxial with longitudinal axes 900 (FIGS. 28A-31C) and 1000 (FIGS. 32A-35B).

Needle hub assembly 830 preferably defines a generally tubular body 1110. A rearwardly extending arm 1120 extends axially at both the top and the bottom of tubular portion 1110 and terminates in a right angle finger 1122.

Tubular body 1110 defines a generally open back and a forward facing wall portion 1140 adjacent in which is formed a recess 1142, which communicates with a narrow axial bore 1144, arranged to receive needle 834, which extends therethrough and is held in place, preferably by an adhesive, which is located in recess 1142. Alternatively, needle hub portion 832 may be molded directly onto the needle.

A pair of arms 1150 having a cross-section in the shape of a C, extend generally axially rearwardly of tubular body 1110 and are each formed with a longitudinal slot 1154, ending in a rear surface 1156. Extending circumferentially from each

arm 1150 is a wall portion 1160 at a rearward end of which extends a rearward-facing finger 1162.

Reference is now made to FIGS. 40A and 40B which are simplified pictorial illustrations of a needle guard element which forms part of the automatic needle device of FIG. 27, to FIGS. 41A and 41B which are simplified pictorial illustrations of the needle guard element of FIGS. 40A and 40B taken along the lines XLIA-XLIA and XLIB-XLIB in FIG. 40A, to FIGS. 42A and 42B which are respective top and side view simplified planar illustrations of the needle guard element of FIGS. 40A-41B and to FIGS. 43A, 43B and 43C which are sectional illustrations taken along respective section lines and directions XLIIIA-XLIIIA, XLIIIB-XLIIIB and XLIIIC-XLIIIC in FIGS. 42A and 42B.

As seen in FIGS. 40A-43C, the needle guard element 840 preferably is an integrally formed element, preferably injection molded of plastic. Needle guard 840 preferably has a generally cylindrical configuration and is preferably top-to-bottom and side-to-side symmetric about a longitudinal axis 1200, which, when assembled together with housing element 810, resilient element 820 and needle hub 830 is coaxial with longitudinal axis 900 (FIGS. 28A-31C), longitudinal axis 1000 (FIGS. 32A-35B) and longitudinal axis 1100 (FIGS. 36A-39B).

Needle guard element 840 preferably defines a generally tubular body 1210. A plurality of mutually circumferentially spaced, longitudinally extending, outward facing ribs 1212 are formed on a forward outer surface 1214 of generally tubular body 1210. Extending rearwardly of ribs 1212 is a generally cylindrical portion 1216 having a pair of oppositely inward facing axial ribs 1220 and a rearward-facing notch 1224 at the top thereof. Forward of cylindrical portion 1216 and generally in line with notch 1224 there is formed in forward outer surface 1214 a socket 1228 and a bifurcated socket 1229. The notch formed between socket 1228 and bifurcated socket 1229 defines an inclined surface 1230.

Formed on an inner cylindrical surface 1231 of generally tubular body 1210 are a pair of longitudinally extending inner facing ribs 1232 which each terminate in a rearward facing finger 1234 located just forward of generally cylindrical portion 1216. Also formed on inner cylindrical surface 1231 are a pair of longitudinally extending inner facing ribs 1236 which are intersected by sockets 1228 and 1229.

Tubular body 1210 defines a generally open back and a forward facing wall portion 1240, defining an injection site engagement surface characterized in that it has a peripheral array of mutually spaced forwardly extending protrusions 1246. Forward facing wall portion 1240 is formed with an axial bore 1250, arranged to allow needle 834 to extend therethrough.

The needle guard element 840 may optionally be formed a pair of side-to-side symmetric windows, to allow viewing of the tip of the needle 834, for example when purging air bubbles from a syringe. Alternatively, needle guard element 840 may be formed of a transparent material.

Reference is now made to FIGS. 44A, 44B, 44C, 44D, 44E and 44F which are pictorial illustrations of various stages in typical use of the automatic needle device of FIG. 27. The automatic needle device of FIG. 27 is stored prior to use in a pre-use operative orientation.

As shown in FIG. 44A, the user may attach a syringe 1302 to the automatic needle device of FIG. 27, by inserting a forward end 1304 of the syringe into generally tubular portion 910 of housing element 810. A plunger 1306 is inserted in syringe 1302. The operative orientation of the automatic needle device at this stage is described hereinbelow with reference to FIGS. 45-47D.

The user then actuates the automatic needle device by removing safety tab **812** and pushing the needle device against an injection site, as shown in FIG. **44B** and as described hereinbelow with reference to FIGS. **48-50D**. In response to user actuation, needle penetration takes place at the needle site, as shown in FIG. **44C**. The operative orientation of the automatic needle device at this stage is described hereinbelow with reference to FIGS. **51-53D**.

Immediately following needle penetration, drug delivery takes place by the user pushing plunger **1303** of syringe **1302** inward. The operative orientation of the automatic needle device immediately following completion of drug delivery is shown in FIG. **44D** and is described hereinbelow with reference to FIGS. **54-56D**.

As seen in FIG. **44E**, the automatic needle device is then manually disengaged from the injection site. The operative orientation of the automatic injection device at this stage is described hereinbelow with reference to FIGS. **57-59D**. Immediately upon disengagement, the needle is protected by the needle guard element **840**.

Should the needle guard be forced axially rearward as shown in FIG. **44F**, its rearward movement produces corresponding rearward motion of the needle hub assembly **830**. The operative orientation of the automatic needle device in this case is described hereinbelow with reference to FIGS. **60-62D**.

Reference is now made to FIG. **45**, which is a simplified assembled view illustration of the automatic needle device of FIGS. **27** and **44A** in a pre-use operative orientation coupled to a syringe and prior to removal of a safety tab, to FIGS. **46A** and **46B**, which are respective top and side view simplified planar illustrations thereof, to FIGS. **47A** and **47B**, which are sectional illustrations taken along respective section lines and directions XLVIA-XLVIA and XLVIB-XLVIB in FIGS. **46A** and **46B**, to FIG. **47C** which is a simplified illustration corresponding to FIG. **46A** with the needle guard hidden and to FIG. **47D** which is a simplified partially cut-away illustration of the needle guard element **840** and the needle hub assembly **830** of FIG. **46B**.

As seen in FIGS. **45-47D**, in a pre-use operative orientation of the automatic needle device, the needle hub assembly **830** is urged forwardly along axis **900** relative to housing element **810** by tensioned arms **1033** and **1034** of resilient element **820**. End portions **1037** of arms **1033** and **1034** engage corresponding rearward facing fingers **1162** of needle hub assembly **830**, while the cylindrical portion **1010** of the resilient element **820** is retained in socket **954** formed in housing element **810**.

The housing element **810** retains the needle hub assembly **830** against axial forward displacement relative to housing element **810** by engagement of rearward facing shoulders **926** of ribs **920** of housing element **810** with corresponding rear surfaces **1156** of longitudinal slots **1154** formed in arms **1150** of needle hub assembly **830**.

In the pre-use operative orientation of the automatic needle device, the needle guard element **840** is urged forwardly along axis **900** relative to housing element **810** by tensioned arms **1035** and **1036** of resilient element **820**. End portions **1037** of arms **1035** and **1036** engage corresponding rearward facing fingers **1234** formed on inner cylindrical surface **1231** of generally tubular body **1210** of the needle guard element **840**, while the cylindrical portion **1010** of the resilient element **820** is retained in socket **954** formed in housing element **810**.

The needle hub assembly **830** retains the needle guard element **840** against axial forward displacement relative to housing element **810** by engagement of right angle fingers

**1122** of needle hub assembly **830** with bifurcated sockets **1229** formed in needle guard element **840**.

Safety tab **812** mounted on flange **916** of housing element **810** prevents rearward axial displacement of needle guard element **840** relative to housing element **810**.

Reference is now made to FIG. **48**, which is a simplified pictorial illustration of the automatic needle device of FIGS. **27** and **44B** in an injection site engagement operative orientation following removal of the safety tab **812** from housing element **810**, to FIGS. **49A** and **49B**, which are respective top and side view simplified planar illustrations thereof, to FIGS. **50A** and **50B** which are sectional illustrations taken along respective section lines and directions LA-LA and LB-LB in FIGS. **49A** and **49B**, to FIG. **50C** which is a simplified illustration corresponding to FIG. **49A** with the needle guard hidden and to FIG. **50D** which is a simplified partially cut-away illustration of the needle guard element **840** and the needle hub assembly **830** of FIG. **49B**.

As seen particularly in FIG. **50A**, due to engagement of the needle guard element **840** with an injection site on a body, the needle guard **840** is forced, against the urging of tensioned arms **1035** and **1036**, to move axially in a rearward direction with respect to the housing element **810**. This displacement stretches tensioned arms **1035** and **1036**.

This rearward repositioning of needle guard element **840** produces an identical rearward displacement of needle hub assembly **830**, against the urging of tensioned arms **1033** and **1034**, by virtue of engagement of right angle fingers **1122** of needle hub assembly **830** with bifurcated sockets **1229** formed in needle guard element **840**. This displacement stretches tensioned arms **1033** and **1034**.

The rearward displacement of the needle hub assembly **830** causes the needle **834** to be displaced rearwardly by an identical amount with respect to cylindrical portion **1018** of resilient element **820**.

Reference is now made to FIG. **51**, which is a simplified pictorial illustration of the automatic needle device of FIGS. **27** and **44C** in a needle actuated operative orientation, to FIGS. **52A** and **52B** which are respective top and side view simplified planar illustrations thereof, to FIGS. **53A** and **53B** which are sectional illustrations taken along respective section lines and directions LIIIA-LIIIA and LIIIB-LIIIB in FIGS. **52A** and **52B**, to FIG. **53C** which is a simplified illustration corresponding to FIG. **52A** with the needle guard hidden and to FIG. **53D** which is a simplified partially cut-away illustration of the needle guard element **840** and the needle hub assembly **830** of FIG. **52B**.

As seen particularly in FIG. **53A**, due to rearward displacement of the needle guard element **840** and of the needle hub assembly **830** relative to the housing element **810** and specifically relative to planar portion **934** thereof, the right angle fingers **1122** are now free to be cantilevered inwardly by sliding along rearward facing inclined surfaces **1230** and to slide forwardly along tapered rearward facing surfaces **938** thereof and along inner facing surfaces of planar portions **934**, thus permitting axial forward motion of the needle hub assembly **830** under the urging of tensioned arms **1033** and **1034**, which become less stretched as a result.

The forward displacement of the needle hub assembly **830** causes the needle **834** to be displaced forwardly with respect to cylindrical portion **1018** of resilient element **820**.

The forward axial motion of the needle hub assembly **830** produces needle penetration at the injection site.

Reference is now made to FIG. **54**, which is a simplified pictorial illustration of the automatic needle device of FIGS. **27** and **44D** in a full needle penetration and an immediately post drug delivery operative orientation, to FIGS. **55A** and

55B, which are respective top and side view simplified planar illustrations thereof, to FIGS. 56A and 56B, which are sectional illustrations taken along respective section lines and directions LVIA-LVIA and LVIB-LVIB in FIGS. 55A and 55B, to FIG. 56C which is a simplified illustration corresponding to FIG. 55A with the needle guard hidden and to FIG. 56D which is a simplified partially cut-away illustration of the needle guard element 840 and the needle hub assembly 830 of FIG. 55B.

It is seen that the needle hub assembly 830 is a forward axial position, at which right angle fingers 1122 are seated in respective sockets 948, thus locking the needle hub assembly 830 to housing element 810. In this position, the right angle fingers 1122 are bent circumferentially and radially inward and are retained in this orientation by engagement with respective ribs 1236 formed on inner cylindrical surface 1231 of needle guard element 840. The further axial forward motion of the needle hub assembly 830 under the urging of tensioned arms 1033 and 1034 causes arms 1033 and 1034 to be even less stretched.

Full needle penetration is provided at this stage and a user normally injects a drug into the injection site by depressing plunger 1306 of syringe 1302.

Reference is now made to FIG. 57 which is a simplified pictorial illustration of the automatic needle device of FIGS. 27 and 14E in a post-drug delivery, needle guarded operative orientation, to FIGS. 58A and 58B, which are respective top and side view simplified planar illustrations of the automatic needle device of FIG. 57, to FIGS. 59A and 59B which are sectional illustrations taken along respective section lines and directions LIXA-LIXA and LIXB-LIXB in FIGS. 58A and 58B, to FIG. 59C which is a simplified illustration corresponding to FIG. 58A with the needle guard hidden and to FIG. 59D which is a simplified partially cut-away illustration of the needle guard element 840 and the needle hub assembly 830 of FIG. 58B.

FIGS. 57-59D illustrate the automatic needle device fully disengaged from the needle site and the needle guard element 840 fully extended under the urging of tensioned arms 1035 and 1036 to fully enclose the needle 834. The needle guard 840 is prevented from moving further forward by engagement of right angle fingers 1122 of needle hub assembly 830 in respective sockets 1128 formed in needle guard element 840 and by engagement of rearward facing shoulders 926 of ribs 920 of housing element 810 with corresponding rear surfaces 1156 of longitudinal slots 1154 formed in arms 1150 of needle hub assembly 830.

Reference is now made to FIG. 60 which is a simplified pictorial illustration of the automatic needle device of FIGS. 27 and 44F in a needle guard pushed back misuse operative orientation, to FIGS. 61A and 61B which are respective top and side view simplified planar illustrations of the automatic needle device of FIG. 60, to FIGS. 62A and 62B are sectional illustrations taken along respective section lines and directions LXIIA-LXIIA and LXIIB-LXIIB in FIGS. 61A and 61B, to FIG. 62C which is a simplified illustration corresponding to FIG. 61A with the needle guard hidden and to FIG. 62D which is a simplified partially cut-away illustration of the needle guard element 840 and the needle hub assembly 830 of FIG. 61B.

FIGS. 60-62D illustrate an important feature of the present invention provided by engagement of right angle fingers 1122 of needle hub assembly 830 in respective sockets 1128 formed in needle guard 840. Should the needle guard 840 be pushed rearwardly with respect to housing element 810, needle hub assembly 830 and needle 834 move axially rearwardly together with needle guard element, so that the needle

834 does not protrude from the needle guard 840. It is appreciated that the automatic needle device can be attached to various types of injection devices, and that the a luer adapter defined by an internal tapered surface of the tubular portion 110 of the housing element 10 of the automatic needle device may be readily modified for engagement with various injection devices such as pen injectors. It is also possible to integrate the automatic needle apparatus described herein into another injection device and thus to eliminate the need for a luer adapter.

Reference is now made to FIGS. 63-75B, which illustrate an automatic needle device constructed and operative in accordance with yet another preferred embodiment of the present invention. The embodiment of FIGS. 63-75B is a modification of the embodiment of FIGS. 1-26B. Accordingly, for the sake of conciseness, it is described in somewhat abbreviated form hereinbelow:

As seen with particular clarity in FIG. 63, the automatic needle device comprises a housing element 1510 into which are generally coaxially seated respective first and second compression springs 1520 and 1522, which provide selectable forward displacement to a needle hub assembly 1530, which includes a hub portion 1532 and a needle 1534 adhesively adhered thereto and rearwardly coupled to a forward end of an elastic tube 1536, whose rearward end is coupled to a liquid passage passageway formed in housing element 1510, and to a needle guard element 1540. Alternatively, needle hub portion 1532 may be injected onto the needle, by a method such as insert molding.

A safety tab 1560 is preferably mounted onto the forward section of housing element 1510, thus disabling actuation of the automatic needle device. The automatic needle device is only functional once the safety tab is removed, as described hereinbelow.

It will be appreciated that safety tab 1560 can be formed of any suitable material for example such as polypropylene, and may be formed in various configurations, such as a portion which is inserted into a slot between the needle guard element 1540 and the housing element 1510, as a stand alone injection molded part, or as an integral part of any of the parts of the automatic needle device such as the housing element 1510 as described hereinabove with reference to FIGS. 27-62D, the needle guard element 1540 or the needle hub assembly 1530.

It will additionally be appreciated by those skilled in the art that compression springs 1520 and 1522 may be replaced with a resilient element as described hereinabove with reference to FIGS. 27-62D. Alternatively, compression springs 1520 and 1522 may be replaced by tension springs, elastomeric compression springs or plastic springs which are preferably integrated into housing element 1510, into needle hub assembly 1530 or into needle guard element 1540.

Reference is now made to FIGS. 2A and 2B, which are simplified pictorial illustrations of a preferred housing element 10 which forms part of the automatic needle device of FIG. 1, to FIGS. 3A and 3B are respective top and side view simplified planar illustrations thereof, to FIGS. 4A and 4B which are sectional illustrations taken along respective section lines and directions IVA-IVA and IVB-IVB in FIGS. 3A and 3B and to FIGS. 5A and 5B which are pictorial sectional illustrations taken along respective section lines and directions VA-VA and VB-VB in FIG. 2A.

Housing element 1510 is identical to the housing element 10 other than in the following respect, shown in FIG. 63:

Communicating with an interior of rearward generally tubular portion 1610 there is provided a narrow passageway 1652 which sealingly receives the rearward end of elastic tube 1536.

Reference is now made to FIGS. 6A and 6B, which are simplified pictorial illustrations of a needle hub assembly 30 which forms part of the automatic needle device of FIG. 1, to FIGS. 7A and 7B, which are respective top and side view simplified planar illustrations of the needle hub assembly of 5 FIGS. 6A and 6B, to FIGS. 8A and 8B, which are sectional illustrations taken along respective section lines and directions VIIIA-VIIIA and VIIIB-VIIIB in FIGS. 7A and 7B and to FIGS. 9A and 9B, which are pictorial sectional illustrations taken along respective section lines and directions IXA-IXA 10 and IXB-IXB in FIG. 6A.

Needle hub assembly 1530 is identical to needle hub assembly 30 shown in FIGS. 6A-9B, except in that the needle 1534 is shorter than needle 34 in the embodiment of FIGS. 1-26B, due to the provision of the elastic tube 1536, the 15 forward end of which is sealingly located in a narrow passageway 1654 provided in the needle hub assembly.

Reference is now made to FIGS. 10A and 10B, which are simplified pictorial illustrations of a needle guard element 40 which forms part of the automatic needle device of FIG. 1, to FIGS. 11A and 11B, which are respective top and side view simplified planar illustrations of the needle guard element of FIGS. 10A and 10B, to FIGS. 12A and 12B, which are sectional illustrations taken along respective section lines and directions XIIA-XIIA and XIIB-XIIB in FIGS. 11A and 11B 20 and to FIGS. 13A and 13B which are pictorial sectional illustrations taken along respective section lines and directions XIII A-XIII A and XIIB-XIIB in FIG. 10A.

The needle guard element 1540 is identical to needle guard element 40 shown in FIGS. 10A-13B.

Reference is now made to FIGS. 14A, 14B, 14C and 14D which when taken together form a simplified pictorial illustration of various stages of typical use of the automatic needle device of FIG. 1. FIGS. 14A-14D also illustrate the various stages of typical use of the automatic needle device of FIG. 63 25 and the above description of FIGS. 14A-14D applies to the embodiment of FIGS. 63-75B as well.

Reference is now made to FIGS. 64A and 64B, which are simplified assembled view illustrations of the automatic needle device of FIG. 63 in a pre-use operative orientation, to FIGS. 65A and 65B, which are respective top and side view simplified planar illustrations thereof and to FIGS. 66A and 66B, which are sectional illustrations taken along respective section lines and directions LXVIA-LXVIA and LXVIB-LXVIB in FIGS. 65A and 65B.

As seen in FIGS. 64-66B, in a pre-use operative orientation of the automatic needle device, suitable for storage, the housing element 1510 is joined to the needle hub assembly 1530 by engagement of inner facing teeth 1824 into apertures 1644 formed in the cylindrical walls of bore 1636. First and second compression springs 1520 and 1522 are located mutually coaxially within housing element 1510. Compression spring 1520 is maintained under compression between forward-facing back wall surface 1655 of generally cylindrical portion 1618 of housing element 1510 and rearward facing wall portion 1850 of hub assembly 1530. Compression spring 1522 is maintained under compression between forward facing back wall surface 1655 and rearward facing ends 1913 and 1915 of needle guard element 1540, which is slidably retained against forward movement by the positioning of curved rearward facing portions 1916 and 1918 thereof immediately rearward of teeth 1826 of needle hub assembly 1530.

The needle hub assembly 1530 is retained in its place by engagement of outwardly facing surface of inner facing teeth 1824 of rearwardly extending arm 1820 and curved rearward facing portions 1916 and 1918 of needle guard element 1540, thus preventing rearwardly extending arms 1820 of needle

hub assembly 1530 from bending outwards and releasing the engagement of inner facing teeth 1824 and apertures 1644 formed in the cylindrical walls of bore 1636 of the housing 1510. The tubular portion 2104 of safety tab 1560 prevents the needle guard element 1540 from moving backwards and actuating needle penetration.

It is seen that the elastic tube 1536 is in a relatively compressed state and is coupled at a forward end thereof to narrow passageway 1654 provided in the needle hub assembly 1530 and is coupled at a rearward end thereof to narrow passageway 1652 formed in housing element 1510.

Reference is now made to FIG. 67, which is a simplified pictorial illustration of the automatic needle device of FIG. 63 after coupling thereto of a syringe 2002 in an injection site engagement operative orientation, to FIGS. 68A and 68B, which are respective top and side view simplified planar illustrations thereof and to FIGS. 69A and 69B, which are sectional illustrations taken along respective section lines and directions LXIXA-LXIXA and LXIXB-LXIXB in FIGS. 68A and 68B.

As seen particularly in FIG. 69A, due to engagement of the needle guard element 1540 with an injection site on a body, the needle guard 1540 is forced, against the urging of spring 1522, to move axially in a rearward direction with respect to the remainder of the automatic needle device, thus sliding curved rearward facing portions 1916 and 1918 thereof further rearward of teeth 1826 of needle hub assembly 1530.

This rearward repositioning of curved rearward facing portions 1916 and 1918 and the pressure of spring 1520, allow arms 1820 of needle hub assembly 1530 to cantilever outward.

It is seen that the elastic tube 1536 is in a relatively extended state.

Reference is now made to FIG. 70, which is a simplified pictorial illustration of the automatic needle device of FIG. 63 in an actuated operative orientation, to FIGS. 71A and 71B which are respective top and side view simplified planar illustrations thereof and to FIGS. 72A and 72B which are sectional illustrations taken along respective section lines and directions LXXIIA-LXXIIA and LXXIIB-LXXIIB in FIGS. 71A and 71B.

As seen particularly in FIG. 72A, under the urging of spring 1520, inner facing teeth 1824 slide out of apertures 1644 formed in the cylindrical walls of bore 1636, thus allowing the needle hub assembly 1530 to move axially forward and to provide needle penetration. The forward motion of needle hub assembly 1530 stops when protrusions 1812 and 1814 come into touching engagement with inwardly extending transverse ribs 1626 of the housing 1510. At this stage, drug delivery may take place in response to manual operation of a syringe 2002.

It is seen that the elastic tube 1536 is in a highly extended state.

Reference is now made to FIG. 73, which is a simplified pictorial illustration of the automatic needle device of FIG. 63 in a post-drug delivery, needle guarded operative orientation, to FIGS. 74A and 74B, which are respective top and side view simplified planar illustrations thereof and to FIGS. 75A and 75B, which are sectional illustrations taken along respective section lines and directions LXXVA-LXXVA and LXXVB-LXXVB in FIGS. 74A and 74B.

FIGS. 73-75B illustrate the automatic needle device fully disengaged from the injection site and the needle guard 1540 fully extended under the urging of spring 1522 to fully enclose the needle 1534. The needle guard 1540 is prevented from moving farther forwards by engagement of curved rearward facing portions 1916 and 1918 and rearwardly extend-

25

ing surface **1830** of teeth **1826** of needle hub assembly **1530**. The needle hub assembly **1530** is prevented from moving further forward by protrusions **1812** and **1814** leaning against inwardly extending transverse ribs **1626** of the housing **1510**. The needle guard **1540** is prevented from moving rearwardly by outwardly facing tooth **1926** which snap-fits in front of inwardly extending transverse ribs **1626** of the housing **1510**. Therefore, at this stage the needle guard **1540** is locked in place keeping the needle protected. It is seen that the elastic tube **1536** remains in a highly extended state. It is appreciated that the automatic needle device can be attached to various types of injection devices, and that the a luer adapter defined by an internal tapered surface of the tubular portion **110** of the housing element **10** of the automatic needle device may be readily modified for engagement with various injection devices such as pen injectors. It is also possible to integrate the automatic needle apparatus described herein into another injection device and thus to eliminate the need for a luer adapter.

It will be appreciated by persons skilled in the art that the present invention is not limited to what has been particularly shown and described hereinabove. Rather the scope of the present invention includes both combinations and subcombinations of various features described hereinabove as well as modifications of such features which would occur to a person of ordinary skill in the art upon reading the foregoing description and which are not in the prior art.

The invention claimed is:

1. An automatic needle device comprising:
  - a housing element;
  - at least one resilient element arranged to be located within said housing element;
  - at least one needle bearing element adapted, when actuated, to be displaced by said at least one resilient element with respect to said housing element from a non-penetration position to a penetration position; and
  - a needle guard adapted for positioning with respect to said housing element and wherein displacement of said needle guard relative to said housing element operative to actuate displacement of said at least one needle bearing element from said non-penetration position to said penetration position.
2. An automatic needle device according to claim 1 and wherein rearward displacement of said needle guard is operative to actuate displacement of said at least one needle bearing element from said non-penetration position to said penetration position.
3. An automatic needle device according to claim 1 and also comprising a safety element adapted to prevent inadvertent actuation of displacement of said at least one needle bearing element.
4. An automatic needle device according to claim 3 and wherein said safety element prevents inadvertent rearward displacement of said needle guard.
5. An automatic needle device according to claim 1 and wherein said at least one resilient element comprises a unitary resilient element.
6. An automatic needle device according to claim 1 and wherein said at least one resilient element comprises first and second coil springs.
7. An automatic needle device according to claim 1 and wherein said housing element includes an injection device engagement portion.
8. An automatic needle device according to claim 7 and wherein said housing element and said at least one needle bearing element together define a fluid pathway from said injection device engagement portion through said needle at

26

least when said needle bearing element is in both said non-penetration position and said penetration position.

9. An automatic needle device according to claim 1 and wherein said needle guard is displaceable by said at least one resilient element.

10. An automatic needle device according to claim 1 and wherein said at least one resilient element comprises first and second compression springs which provide selectable forward displacement to said at least one needle bearing element.

11. An automatic needle device according to claim 1 and wherein said needle bearing element includes a hub portion and a needle adhered thereto and extending through a septum.

12. An automatic needle device according to claim 1 and also comprising a safety tab operative for disabling actuation of the automatic needle device.

13. An automatic needle device according to claim 12 and wherein said safety tab includes a spacer portion and a tab portion.

14. An automatic needle device according to claim 1 and wherein said housing element is an integrally formed element having a generally cylindrical configuration and is generally top-to-bottom and side-to-side symmetric about a longitudinal axis.

15. An automatic needle device according to claim 1 and wherein said housing element includes a rearward generally tubular portion which terminates in an open back and defines forwardly thereof a generally cylindrical portion, whose outer configuration includes top and bottom grip regions.

16. An automatic needle device according to claim 1 and wherein said housing element includes first and second forwardly and rearwardly tapered side protrusions.

17. An automatic needle device according to claim 15 and comprising at an inner surface of said generally cylindrical portion forward and rearward inwardly extending transverse ribs and a plurality of inwardly extending longitudinal slots.

18. An automatic needle device according to claim 1 and wherein said housing element is formed with a pair of side-to-side symmetric windows, to allow viewing of the tip of a needle held by said needle bearing element.

19. An automatic needle device according to claim 1 and wherein said needle bearing element comprises a needle hub and a needle.

20. An automatic needle device according to claim 19 and wherein said needle bearing element has a generally cylindrical configuration and is top-to-bottom and side-to-side symmetric about a longitudinal axis.

21. An automatic needle device according to claim 19 and wherein said needle bearing element defines a generally tubular body having formed thereon a pair of up-down mutually spaced, forwardly facing, outwardly extending hook protrusions.

22. An automatic needle device according to claim 21 and wherein said protrusions are each associated with a rearward facing rib.

23. An automatic needle device according to claim 21 and wherein a rearwardly extending arm is formed at both a top and a bottom of said tubular body, each arm including, adjacent an extreme rearwardly facing end thereof, a tapered inwardly facing tooth and forwardly thereof an outwardly facing tooth, having a transversely extending rearwardly facing surface.

24. An automatic needle device according to claim 21 and wherein top and bottom pairs of outwardly facing ribs are formed on said tubular portion, adjacent respective rearward

27

facing ribs, said outwardly facing ribs being operative to slidably locate said needle bearing element within said needle guard.

25. An automatic needle device according to claim 21 and wherein said tubular body defines a generally open back and a forward facing wall portion adjacent in which is formed a recess, which communicates with a narrow axial bore, arranged to receive said needle, which extends therethrough.

26. An automatic needle device according to claim 21 and wherein a rearward facing external wall portion, located at a rearward end of said tubular body, defines a seat for said at least one resilient element.

27. An automatic needle device according to claim 1 and wherein said needle guard has a generally cylindrical configuration and is top-to-bottom and side-to-side symmetric about a longitudinal axis.

28. An automatic needle device according to claim 1 and wherein said needle guard defines a generally tubular body having formed thereon a plurality of circumferentially spaced, longitudinally extending, outward facing ribs, having rearward facing ends, said outward facing ribs being adapted to slidably locate said needle guard within inwardly extending longitudinal slots of said housing element.

29. An automatic needle device according to claim 28 and wherein extending rearwardly of said outwardly facing ribs there is provided a curved rearward facing portion having a pair of inwardly facing ribs formed therein, and, extending rearwardly of said ribs, there is formed a symmetrically curved rearward facing portion having a pair of ribs formed therein.

30. An automatic needle device according to claim 29 and wherein said curved rearward facing portions together with said rearward facing ends define a seat for a spring forming part of said at least one resilient element.

31. An automatic needle device according to claim 29 and wherein said inwardly facing ribs are operative to slidably locate said needle bearing element within said needle guard, by allowing said outwardly facing ribs to slide therein.

32. An automatic needle device according to claim 28 and wherein a rearwardly extending arm is formed at each side of said tubular body, each of said arms including adjacent an extreme rearwardly facing end thereof, an outwardly facing tooth, having an inclined forward surface and a transversely extending rearwardly facing surface.

33. An automatic needle device according to claim 28 and wherein said tubular body defines a generally open back and a forward facing wall portion, defining an injection site engagement surface.

34. An automatic needle device according to claim 33 and wherein said injection site engagement surface includes a pair

28

of mutually concentric circles of mutually spaced forwardly extending protrusions and said forward facing wall portion is formed with an axial bore, arranged to allow a needle to extend therethrough.

35. An automatic needle device according to claim 1 and wherein said needle guard is formed with a pair of side-to-side symmetric windows, to allow viewing of the tip of a needle.

36. An automatic needle device according to claim 1 and wherein, in a pre-use operative orientation suitable for storage, said housing element is joined to said needle bearing element by snap fit engagement of inner facing teeth formed on said needle bearing element into apertures formed in cylindrical walls of said housing element.

37. An automatic needle device according to claim 36 and wherein said at least one resilient element comprises first and second compression springs, said first compression spring being maintained under compression between forward-facing back wall surface of a generally cylindrical portion of said housing element and a rearward facing wall portion of said needle bearing element and said second compression spring being maintained under compression between said forward facing back wall surface and rearward facing ends of said needle guard, which is slidably retained against disassembly forward movement by the positioning of curved rearward facing portions thereof immediately rearward of said inner facing teeth of said needle bearing element.

38. An automatic needle device according to claim 36 and wherein said needle bearing element is retained in its place by engagement of rearwardly outwardly facing surfaces of said inner facing teeth with curved rearward facing portions of said needle guard, thus preventing rearwardly extending arms of said needle bearing element from bending outwardly and releasing the snap fit engagement of said inner facing teeth and apertures formed in the cylindrical walls of said cylindrical bore of said housing element.

39. An automatic needle device according to claim 38 and wherein due to engagement of said needle guard with an injection site on a body, said needle guard is forced, against the urging of said at least one resilient element, to move axially in a rearward direction with respect to the remainder of the automatic needle device, thus sliding said curved rearward facing portions thereof further rearward of outwardly facing teeth of said needle bearing element, thus allowing said arms of said needle bearing element to cantilever outwardly.

40. An automatic needle device according to claim 36 and wherein at all times said needle sealingly and slidably engages a septum.

\* \* \* \* \*